

**TECHNICAL MANUAL**

**DIRECT SUPPORT, GENERAL SUPPORT**

**OR**

**AVIATION INTERMEDIATE MAINTENANCE  
(AVIM)**

**RECEIVER-TRANSMITTER, RADIO**

**RT-859A/APX-72**

**(NSN 5895-00-149-1319)**

**USING TEST SET AN/APM-305A**

**(NSN 6625-01-052-3881)**

This copy is a reprint which includes current  
pages from Change 1.

**HEADQUARTERS, DEPARTMENT OF THE ARMY  
5 JANUARY 1982**

## WARNINGS

- 1000 vdc is present on pin A1 of connector P2, associated resistors, and load bank wiring.
- Terminals adjacent to receiver tuning adjustments are at voltage levels hazardous to life.
- Lethal voltages are present when power is applied to the test setup. These dangerous voltages are present at exposed (identified by red cables and pins indicating 1000 vdc connections).
- Lethal voltages are present in tester and PS1 when primary power is applied.
- Lethal voltages are present in PS1 and load bank when primary power is applied. These voltages are present on A1 and P2 in load bank and the associated resistors and wiring, and on terminal A1 of the open power supply.

**DON'T TAKE CHANCES!**

CHANGE }  
No. 1 }

TM 11-5895-490-34-1

C 1

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
WASHINGTON, DC, 11 May 1984

**Direct Support, General Support  
or  
Aviation Intermediate Maintenance (AVIM)  
RECEIVER-TRANSMITTER, RADIO RT-859A/APX-72  
(NSN 5895-00-149-1319)  
USING TEST SET AN/APM-305A  
(NSN 6625-01-052-3881)**

TM 11-5895-490-34-1, 5 January 1982, is changed as follows:

1. New or changed material is indicated by a vertical bar in the margin of the page.
2. Added or revised illustrations are indicated by a vertical bar in front of the figure caption.
3. Remove and insert pages as indicated below:

*Remove*

i and ii

1-1/(1-2 blank)

2-1 and 2-2

3-1 through 3-10

3-99

A-1/(A-2 blank)

*Insert*

i and ii

1-1/(1-2 blank)

2- and 2-2

3-1 through 3-9

3-99 through 3-113/(3-114 blank)

A-1/(A-2 blank)

4. File this change sheet in front of the publication.

By Order of the Secretary of the Army:

JOHN A. WICKHAM JR.  
General, United States Army  
Chief of Staff

Official:

ROBERT M. JOYCE  
Major General, United States Army  
The Adjutant General

**DISTRIBUTION:**

To be distributed in accordance with DA Form 12-36, Direct and General Support Maintenance requirements for AN/APX-72.





**DIRECT SUPPORT, GENERAL SUPPORT  
OR  
AVIATION INTERMEDIATE MAINTENANCE (AVIM)  
RECEIVER-TRANSMITTER, RADIO  
RT-859A/APX-72  
(NSN 5895-00-149-1319)  
USING TEST SET AN/APM-305A  
(NSN 6625-01-052-3881)**

**REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS**

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: DRSEL-ME-MP, Fort Monmouth, New Jersey 07703. In either case, a reply will be furnished direct to you.

| CHAPTER |                                                                                 | Paragraph | Page  |
|---------|---------------------------------------------------------------------------------|-----------|-------|
| 1.      | INTRODUCTION                                                                    |           |       |
|         | Scope .....                                                                     | 1-1       | 1-1   |
|         | Consolidated Index of Army Publications and Blank Forms .....                   | 1-2       | 1-1   |
|         | Maintenance Forms, Records, and Reports .....                                   | 1-3       | 1-1   |
|         | Administrative Storage .....                                                    | 1-4       | 1-1   |
|         | Destruction of Army Electronics Materiel .....                                  | 1-5       | 1-1   |
|         | Reporting Equipment Improvement Recommendations (EIR) .....                     | 1-6       | 1-1   |
| 2.      | GENERAL INSTRUCTIONS                                                            |           |       |
|         | Disassembly and Assembly .....                                                  | 2-1       | 2-1   |
|         | Support Equipment Required .....                                                | 2-2       | 2-1   |
|         | Construction of Load Bank Assembly .....                                        | 2-3       | 2-1   |
| 3.      | MAINTENANCE INSTRUCTIONS                                                        |           |       |
|         | Preliminary Procedure .....                                                     | 3-1       | 3-1   |
|         | Receiver Sensitivity, Bandwidth and Center Frequency Performance Test .....     | 3-2       | 3-4   |
|         | Transmitter Power Output and Frequency Test .....                               | 3-3       | 3-5   |
|         | Transponder Reply Code Characteristics Performance Test .....                   | 3-4       | 3-5   |
|         | Transponder Decoding Characteristics Performance Test .....                     | 3-5       | 3-6   |
|         | Transponder Automatic Overload Cutoff (AOC) Performance Test .....              | 3-6       | 3-7   |
|         | Transponder ISLS Performance Test .....                                         | 3-7       | 3-8   |
|         | Transponder Disparity Performance Test .....                                    | 3-8       | 3-8   |
|         | Transponder Receiver Dead Time Performance Test .....                           | 3-9       | 3-9   |
|         | Transponder Suppression Pulse Performance Test .....                            | 3-10      | 3-9   |
|         | General Troubleshooting .....                                                   | 3-11      | 3-9   |
|         | System Troubleshooting .....                                                    | 3-12      | 3-9   |
|         | Subassembly Troubleshooting .....                                               | 3-13      | 3-    |
|         | Disassembly for Troubleshooting .....                                           | 3-14      | 3-    |
|         | Troubleshooting Procedures for DL1 .....                                        | 3-15      | 3-    |
|         | Troubleshooting Procedures for PS1 .....                                        | 3-16      | 3-    |
|         | Alignment and Adjustment Procedures, Transponder Test Set AN/APM-305A .....     | 3-17      | 3-99  |
|         | Performance Tests and Measurements Using Transponder Test Set AN/APM-305A ..... | 3-18      | 3-112 |

\*This manual supersedes TB 11-5895-490-34, 29 December 1978.

Change 1

i

# **TM 11-5895-490-34-1**

|          |    |                                                         |     |     |
|----------|----|---------------------------------------------------------|-----|-----|
| CHAPTER  | 4. | DEPOT INSPECTION STANDARDS .....                        | 4-1 | 4-1 |
| APPENDIX | A. | REFERENCES .....                                        |     | A-1 |
|          | B. | EXPENDABLE SUPPLIES AND MATERIALS LIST (Not Applicable) |     |     |

## **LIST OF ILLUSTRATIONS**

| <i>Number</i> | <i>Title</i>                                            | <i>Page</i> |
|---------------|---------------------------------------------------------|-------------|
| 2-1           | Schematic Diagram, Load Bank Assembly .....             | 2-2         |
| 3-1           | Receiver-Transmitter Test Setup .....                   | 3-2         |
| 3-2           | Receiver-Transmitter Frequency Measurement Charts ..... | 3-4         |
| 3-3           | Normal Reply Pulse Trains .....                         | 3-7         |
| 3-4           | Normal Waveforms For Troubleshooting .....              | 3-12        |
| 3-5           | RT-859A/APX-72 Disassembly .....                        | 3-95        |
| 3-6           | RT-859A/APX-72 Rf Section Subassembly .....             | 3-96        |
| 3-7           | Detector and Vido Amplifier AR3m Disassembly .....      | 3-86        |
| 3-8           | Power Supply Cover Removal .....                        | 3-98        |
| 3-9           | Receiver Alinement Test Setup Using AN/UPM-305A .....   | 3-100       |
| 3-10          | Receiver Transmitter (1090 MHz) Measurements .....      | 3-107       |
| FO-1          | Circuitboard Subassemblies Voltage Measurements         |             |

## **LIST OF TABLES**

| <i>Number</i> | <i>Title</i>                                                         | <i>Page</i> |
|---------------|----------------------------------------------------------------------|-------------|
| 2-1           | Load Bank Assembly Parts List .....                                  | 2-1         |
| 3-1           | AN/USM-281A Initial Control Settings .....                           | 3-3         |
| 3-2           | AN/APM-305A Initial Control Settings .....                           | 3-3         |
| 3-3           | AN/APM-239A Initial Control Settings .....                           | 3-3         |
| 3-4           | Transponder Reply Code Characteristics .....                         | 3-8         |
| 3-5           | Power Supply Voltages .....                                          | 3-13        |
| 3-6           | System Troubleshooting Chart .....                                   | 3-13        |
| 3-7           | Modes 1, 2, 3/A, Test, and C Troubleshooting Chart .....             | 3-12        |
| 3-8           | Mode 4 Troubleshooting Chart .....                                   | 3-12        |
| 3-9           | Extender Boards Reference .....                                      | 3-15        |
| 3-10          | Functional Troubleshooting Chart, Extender Board Procedure .....     | 3-45        |
| 3-11          | Functional Troubleshooting Chart, In-Circuit Procedure .....         | 3-75        |
| 3-12          | Functional Troubleshooting Chart, Out of Circuit Procedure .....     | 3-81        |
| 3-13          | Complete Alinement and Adjustment Procedures Using AN/APM-305A ..... | 3-101       |

## CHAPTER 1

### INTRODUCTION

#### 1-1. Scope

a. This manual provides data for performance testing, troubleshooting, and alignment/adjustment procedures to supplement TM 11-5895-490-35. It also provides direct support, general support or aviation intermediate maintenance (AVIM) instructions using Test Set AN/APM-305A to test Radio Receiver-Transmitter RT-859A/APX-72.

b. The technical manuals applicable to this equipment by the three services are:

|           |                                                                          |
|-----------|--------------------------------------------------------------------------|
| Navy      | NAVAIR 16-30 APX72-2 and -3.<br>NAVSHIPS 0967-217-04010, 4020, and 4030. |
| Army      | TM 11-5895-490-20, -20P, -35, and -34P.                                  |
| Air Force | T.O. 12P4-2APX72-2 and -4.                                               |

#### 1-2. Consolidated Index of Army Publications and Blank Forms

Refer to the latest issue of DA Pam 310-1 to determine whether there are new editions, changes or additional publications pertaining to the equipment.

#### 1-3. Maintenance Forms, Records, and Reports

a. *Reports of Maintenance and Unsatisfactory Equipment.* Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738-750, as contained in maintenance management update.

b. *Report of Packaging and Handling Deficiencies.* Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-11-2/DLAR 4140.55/NAVMA-TINST 4355.73A/AFR 400-54/MCO 4430.3F.

c. *Discrepancy in Shipment Report (DISREP) (SF 361).* Fill out and forward Discrepancy in Shipment Report

(DISREP) (SF 361) as prescribed in AR 55-38/NAVSU-PINST 4610.33C/AFR 75-18/MCO P4610.19D/DLAR 4500.15.

#### 1-4. Administrative Storage

Administrative storage of equipment issued to and used by Army activities will have preventive maintenance performed in accordance with the PMCS charts before storing. When removing the equipment from administrative storage the PMCS should be performed to assure operational readiness. Disassembly and repacking of equipment for shipment or limited storage are covered in paragraph 4-42, TM 11-5895-490-35.

#### 1-5. Destruction of Army Electronics Materiel

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

#### 1-6. Reporting Equipment Improvement Recommendations (EIR)

If your RT-859/APX-72 needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: DRSEL-ME-MP, Fort Monmouth, New Jersey 07703. We'll send you a reply.

## CHAPTER 2

### GENERAL INSTRUCTIONS

---

#### 2-1. Disassembly and Assembly

Procedures included in this technical manual are only those required to perform troubleshooting adjustments. All others are covered in TM 11-5895-490-35.

#### 2-2. Support Equipment Required

##### NOTE

Refer to pertinent publications for operation of support equipment.

|             |                      |
|-------------|----------------------|
| AN/USM-281A | Oscilloscope         |
| AN/APM-239A | Test Set Transponder |
| AN/APM-305A | Test Set Transponder |
| ME-202( )/U | Electronic Voltmeter |
| AN/USM-207A | Electronic Counter   |

TK--100/G

Tool Kit Electronic  
Equipment

TS-3243/APM

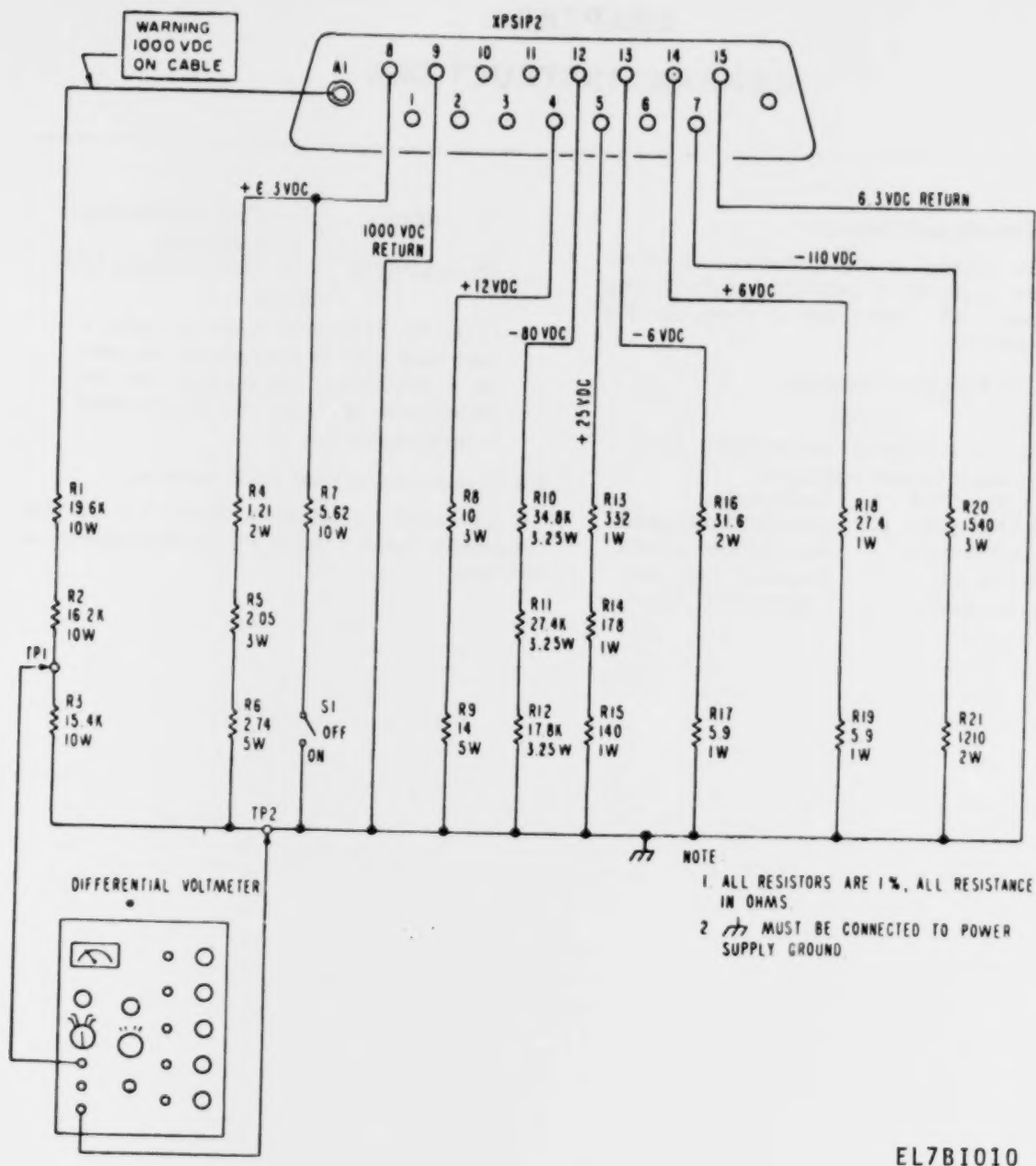
Tester-Dummy Load

##### NOTE

If the TS-3243/APM is not available, a load bank may be constructed and used as a substitute. Instructions for the construction of a load bank are provided in paragraph 2-F3.

#### 2-3. Construction of Load Bank Assembly

a. Use schematic diagram Figure 2-1 and the components listed in table 2-1 for assembling the load bank.



EL7BI010

Figure 2-1. Schematic Diagram, Load Bank Assembly.

- b. Install connector XPSI P2 in one end of a chassis.
- c. Install a common ground at the opposite end of the chassis, using a lug with multiple tie points connected to a grounded feedthrough terminal (not listed in table 2-1).
- d. Install test jacks TP1 and TP2 on chassis in positions conforming to general wiring indicated in figure 2-1.

- e. Install switch S1 on chassis.
- f. Connect resistors R1 and R2 in series between terminal A1 (XPSI P2) and TP1.
- g. Attach warning on chassis adjacent to connector P2 as follows:

**WARNING**  
1000 VDC ON PIN A1 OF CON-  
NECTOR P2, ASSOCIATED

RESISTORS, AND LOAD BANK  
WIRING.

- h. Connect resistor R3 between TP1 and common ground.
- i. Connect TP2 to common ground.
- j. Connect resistors R4, R5, and R6 in series between terminal 8 and common ground.
- k. Connect resistor R7 between terminal 8 and switch S1.
- l. Connect switch S1 to common ground.
- m. Connect a length of wire between terminal 9 and common ground.
- n. Connect resistors R8 and R9 in series between terminal 4 and common ground.
- o. Connect resistors R10, R11, and R12 in series

between terminal 12 and common ground.

p. Connect resistors R13, R14, and R15, in series between terminal 5 and common ground.

q. Connect resistors R16 and R17 in series between terminal 13 and common ground.

r. Connect resistors R18 and R19 in series between terminal 14 and common ground.

s. Connect resistors R20 and R21 in series between terminal 7 and common ground.

t. Connect a length of wire between terminal 15 and common ground.

u. After assembly, make continuity and resistance measurements with switch S1 ON and OFF, to ensure that assembly is correctly wired.

Table 2-1. Load Bank Assembly Parts List

| REFERENCE<br>DESIGNATION | PART<br>NUMBER | DESCRIPTION                                             | QUANTITY |
|--------------------------|----------------|---------------------------------------------------------|----------|
| A1                       | DM-51157       | CONTACT, Electrical, high voltage, straight, ITT Cannon | 1        |
| R1                       | RWR78S1962FM   | RESISTOR, MIL-R-39007                                   | 1        |
| R2                       | RWR78S1622FM   | RESISTOR, MIL-R-39007                                   | 1        |
| R3                       | RWR78S1542FM   | RESISTOR, MIL-R-39007                                   | 1        |
| R4                       | RWR71S1R21FM   | RESISTOR, MIL-R-39007                                   | 1        |
| R5                       | RWR89S2R05FM   | RESISTOR, MIL-R-39007                                   | 1        |
| R6                       | RWR74S2R74FM   | RESISTOR, MIL-R-39007                                   | 1        |
| R7                       | RWR78S5R62FM   | RESISTOR, MIL-R-39007                                   | 1        |
| R8                       | RWR89S10R0FM   | RESISTOR, MIL-R-39007                                   | 1        |
| R9                       | RWR74S14R0FM   | RESISTOR, MIL-R-39007                                   | 1        |
| R10                      | RS2A34R8K1PCT  | RESISTOR, 24.8K, 3.25W Dale Electronics                 | 1        |
| R11                      | RS2A00B1780F   | RESISTOR, 27.4K, 3.25W Dale Electronics                 | 1        |
| R12                      | RS2A17R8K1PCT  | RESISTOR, 17.8K, 3.25W Dale Electronics                 | 1        |
| R13                      | RWR81S3320FM   | RESISTOR, MIL-R-39007                                   | 1        |
| R14                      | RWR81S1780FM   | RESISTOR, MIL-R-39007                                   | 1        |
| R15                      | RWR81S1400FM   | RESISTOR, MIL-R-39007                                   | 1        |
| R16                      | RWR71S31R6FM   | RESISTOR, MIL-R-39007                                   | 1        |
| R17                      | RWR81S5R90FM   | RESISTOR, MIL-R-39007                                   | 1        |
| R18                      | RWR81S27R4FM   | RESISTOR, MIL-R-39007                                   | 1        |
| R19                      | RWR81S5R90FM   | RESISTOR, MIL-R-39007                                   | 1        |
| R20                      | RWR89S1541FM   | RESISTOR, MIL-R-39007                                   | 1        |
|                          | MIL-R-39007    |                                                         | 1        |
| R21                      | RWR71S1211FM   | RESISTOR, MIL-R-39007                                   | 1        |
| S1                       | MS18151-1      | SWITCH, Toggle, single pole                             | 1        |
| TP1                      | MS39024/1-02   | JACK, Electrical, test point, red                       | 1        |
| TP2                      | MS39024/1-03   | JACK, Electrical, test point, black                     | 1        |
| XPS1P2                   | DBM-17W2P      | CONNECTOR, Electrical, receptable ITT Cannon            | 1        |

## Wire Type Specifications MIL-W-16878, Insulation Teflon MIL-M-14077

| AWG<br>SIZE | CONDUCTOR<br>DIA<br>NOMINAL | NO. OF<br>STRANDS<br>MINIMUM | MAX DC RESISTANCE<br>OHMS/1000 FT<br>AT 25°C | DIA OVER<br>INSULATION<br>MAXIMUM |
|-------------|-----------------------------|------------------------------|----------------------------------------------|-----------------------------------|
| 22          | 0.030                       | 19                           | 16.7                                         | 0.054                             |





## CHAPTER 3

### MAINTENANCE INSTRUCTIONS

---

#### 3-1. Preliminary Procedure

a. Connect equipment as shown in figure 3-1. Make additional corrections or modifications as directed in the test procedure.

#### CAUTION

Make sure AN/APM-239A TRANSPONDER SET CONTROL MASTER switch is set to OFF before applying power to AN/APM-239A.

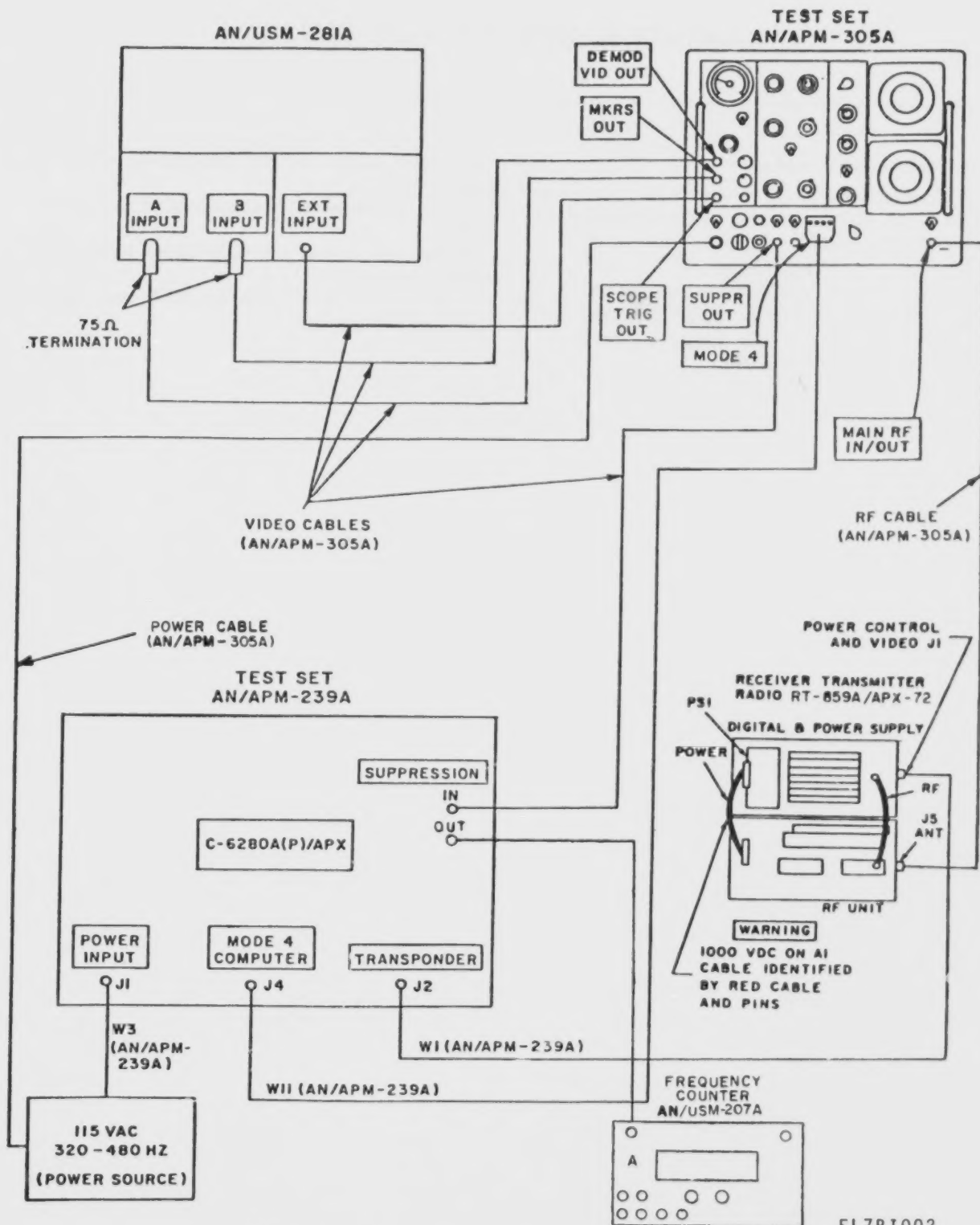
b. Apply power to test equipment; allow 10 minute warmup.

c. Set and adjust oscilloscope controls as listed in table 3-1.

d. Set and adjust AN/APM-305A controls as listed in table 3-2.

e. Set and adjust AM/APM-239A controls as listed in table 3-3.





EL7BI002

Figure 3-1. Receiver-Transmitter Test Setup.

Table 3-1. AN/USM-281A Initial Control Settings

| Control                | Position                                            |
|------------------------|-----------------------------------------------------|
| POWER                  | ON                                                  |
| MAGNIFIER              | X1                                                  |
| EXT + 10 INT LINE      | LINE                                                |
| FIND BEAM              | Released.                                           |
| INTENSITY              | As required.                                        |
| FOCUS                  | Adjust beam for sharpest trace.                     |
| SCALE                  | Adjust for scale illumination.                      |
| HORIZONTAL POSITION    | Adjust horizontal positions of display as required. |
| MAGNIFIER              | X1                                                  |
| DISPLAY                | ALT                                                 |
| AC/DC                  | DC                                                  |
| POSITION               | As required.                                        |
| POLARITY               | + UP                                                |
| A,B VOLTS/DIV          | 0.5                                                 |
| A,B VOLTS/DIV vernier  | CAL                                                 |
| MAGNIFIER              | X1                                                  |
| AC/GND/DC              | AC                                                  |
| MAIN                   |                                                     |
| VERNIER                | CAL                                                 |
| RESET                  | Released.                                           |
| TRIGGER LEVEL          | As required for a stable display.                   |
| EXT/ + 10/EXT/INT/LINE | EXT                                                 |
| - SLOPE +              | +                                                   |
| ACS/ACF/AC/DC          | AC                                                  |
| TIME/DIV               | As required.                                        |
| SWEEP MODE             | AUTO                                                |
| DIV DELAY              | 0.00                                                |
| DELAYED                |                                                     |
| VERNIER                | CAL                                                 |
| TRIGGER LEVEL          | 0                                                   |
| INT/AUTO-EXT + 10      | AUTO                                                |
| - SLOPE +              | +                                                   |
| ACS/ACF/AC/DC          | Ac                                                  |

Table 3-2. AN/APM 305A Initial Control Settings

| Control                       | Position                                                 |
|-------------------------------|----------------------------------------------------------|
| POWER                         | ON (applies ac power to test).                           |
| POWER Indicator               | Lights; indicates ac power applied to test set.          |
| DC FAULT                      | Does not light; lights only if fault in dc power supply. |
| POWER 1.0 AMPS fuse indicator | Does not light; lights only if fuse is blown.            |
| MEASUREMENT                   |                                                          |
| PRF RANGE                     | X100                                                     |
| FUNCTION SELECT               | PRF CHAL                                                 |
| DEMOM VID LEVEL               | Adjust for 1v/p reply pulse                              |
| MAIN ATTEN                    | - 50                                                     |
| AUX ATTEN                     | 0dB (ISLS scale)                                         |
| CHAL SUB PULSE                |                                                          |
| SELECT                        | SIFP1                                                    |
| POSITION                      | 0                                                        |
| VARY                          | Mid-position                                             |
| PRF-SELECT                    |                                                          |
| RANGE                         | X100                                                     |
| MULT                          | 5.0                                                      |
| X $\frac{1}{2}$ -X1           | X1                                                       |
| SCOPE TRIG/FREQ               |                                                          |
| MEAS                          |                                                          |
| DELAY (USEC)                  |                                                          |

Table 3-2. AN/APM 305A Initial Control Settings (continued)

| Control          | Position     |
|------------------|--------------|
| RANGE            | OFF          |
| MULT             | 1.0          |
| CHAL             |              |
| MODE SELECT      | 1            |
| WIDTH            | 0.80         |
| WIDTH VARY       | Mid-position |
| ISLS SPACING     |              |
| SELECT           | 0            |
| VARY             | Mid-position |
| INHIBIT          | OFF          |
| AUX MOD DLY      | 0.2 USEC     |
| DEMOM MAIN/AUX   | MAIN         |
| SIG GEN FUNCTION | FIXED FREQ   |
| SUPPR            | OFF          |
| AUX TRIG         | OFF          |

Table 3-3. AN/APM-239A Initial Control Settings

### CAUTION

Prior to setting AN/APM-239A power controls to "ON" and making appropriate voltage adjustments, be sure that AN/APM-239A TRANSPONDER SET CONTROL MASTER switch is set to OFF.

| Control             | Position                     |
|---------------------|------------------------------|
| PANEL LIGHTS 28v    | OFF                          |
| MODE C ENCODER      |                              |
| SIMULATOR/TEST      |                              |
| CONDITION           | OHMS                         |
| ALTITUDE DIGITIZER  | OUT                          |
| POWER MODE          | AC/DC or DC only as required |
| 6 AMP POWER         | ON                           |
| METER SELECT        | AC                           |
| MODE 4 DISPARITY    | DISPARITY                    |
| MODE 4 REPLY        | REPLY                        |
| MODE 4 REPLY        | TERMINATED with 50 OHM       |
| CONNECTOR           | LOAD                         |
| MODE 4 AUDIO COMMON | TERMINATED TO GROUND         |
| CONNECTOR           |                              |

f. Adjust AN/APM-239A as follows:

- (1) Adjust AC CONTROL until meter indicates 115 vac.
- (2) Set TRANSPONDER SET CONTROL MASTER switch to STBY. Verify that SWITCHED AC POWER light is on (in AC/DC MODE only). Allow 3 minute delay.
- (3) Set METER SELECT switch to DC and adjust DC CONTROL until meter indicates + 27.5 vac.
- (4) Set TRANSPONDER SET CONTROL M-1, M-2, M-3A and M-C switches to ON.
- (5) Set TRANSPONDER SET CONTROL MODE 1 switches to 73 and MODE 3/A switches to 7777.
- (6) Set IFF mode 4 to OFF.
- (7) Set AUDIO/OUT/LIGHT to LIGHT.
- (8) Set all MODE C ENCODER SIMULATOR switches, except D4 INDENT, to ON.
- (9) Set RT-859/A MODE 2 switches to 7777.

### 3-2. Receiver Sensitivity, Bandwidth and Center Frequency Performance Test

Perform the following steps to test receiver sensitivity, band width, and center frequency.

- Connect equipment as shown in figure 3-1.
- Set and adjust oscilloscope controls as shown in table 3-1, except MAIN TIME/DIV to 0.1 MSEC.
- Set AN/APM-305A controls as listed in table 3-2, except set MEASUREMENT FUNCTION SELECT switch to PRF REPLY.
- Set AN/APM-239A controls as listed in table 3-3. Perform preliminary setup of AN/APM-239A described in 3-1f above.
- Set AN/APM-239A TRANSPONDER SET CONTROL MASTER switch to NORM and adjust AN/APM-305A DEMOD VID LEVEL control for 1v p/p on oscilloscope channel B.
- Adjust AN/APM-305A PRF SELECT and MULT controls until MEASUREMENT meter indicates a prf of 500.
- Adjust AN/APM-305A MAIN ATTN control until MEASUREMENT meter indicates a prf of 450.
- Record AN/APM-305A MAIN ATTN control in-

dication in db (MTL); then add the cable losses from transponder to AN/APM-305A. The sum is the transponder sensitivity ( $-77\text{DB} \pm 3\text{DB}$ ).

i. Repeat steps f through h for modes, 2, 3/A and C. There should be no more than 1db difference between modes.

j. Check low receiver sensitivity by setting AN/APM-239A TRANSPONDER SET CONTROL MASTER switch to LOW; then repeat steps f through i. The low sensitivity should be  $-52\text{db} \pm 2\text{db}$  with no more than 2bd difference between MODES.

#### NOTE

Abrupt dropoff, without achieving 450 counts, is acceptable providing low sensitivity falls within  $-52\text{db} \pm 2\text{db}$ .

k. Set AN/APM-239A TRANSPONDER SET CONTROL MASTER switch to NORMAL.

l. Set AN/APM-305A SIG GEN FUNCTION switch to SWP  $\pm 20$  MHz and SCOPE TRIG/FREQ MEAS DELAY (USEC) RANGE switch to X400.

m. Adjust oscilloscope MAIN TIME/DIV and DELAY controls to display markers as shown in figure 3-2.

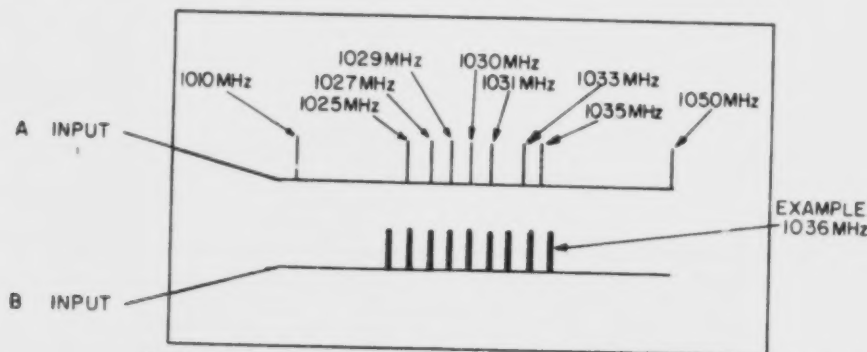


Figure 3-2. Receiver-Transmitter Frequency Measurement Chart.

EL7BI005

n. Adjust AN/APM-305A SCOPE TRIG/FREQ MEAS DELAY (USEC) MULT control until F1 pulse on oscilloscope B INPUT aligns with 1030 MHz marker on A INPUT. Read measurement meter and record the PRF.

o. Multiply the reading in step n above by 0.9 and increase the MAIN ATTN until the PRF is reached (MTL).

p. Set AN/APM-305A MAIN ATTN to a point 6db above setting of step o above (MTL), less attenuation.

q. Rotate AN/APM-305A SCOPE TRIG/FREQ MEAS DELAY (USEC) MULT control clockwise until PRF of step o above (MTL) is observed on MEASUREMENT meter.

r. Using frequency markers on oscilloscope A INPUT, determine frequency of F1 pulse observed on B

INPUT (fig. 3-3A, F1 pulse).

s. Adjust AN/APM-305A SCOPE TRIG/FREQ MEAS DELAY (USEC) MULT control counterclockwise until PRF again reads same as step o above (MTL).

t. Using frequency markers on oscilloscope A input, determine frequency of F1 pulse observed on B input.

u. Determine receiver bandwidth using following formula:  $\text{BW} = (\text{freq of step r above} - \text{freq of step t above}) = 7 \text{ MHz minimum.}$

v. Determine receiver center frequency using following formula:

$$\text{CF} = \frac{(\text{freq of step r above}) + (\text{freq of step t above})}{2}$$

$$= 1030 \pm 1.5 \text{ MHz.}$$

### 3-3. Transmitter Power Output and Frequency Test

Perform the following steps to test transmitter power output:

- a. Connect equipment as shown in figure 3-1.
- b. Set and adjust oscilloscope controls as listed in table 3-1, except MAIN TIME/DIV to 5 uSEC.
- c. Set AN/APM-305A controls as listed in table 3-2, except set MEASUREMENT FUNCTION SELECT switch to PWR.
- d. Set AN/APM-239A controls as listed in table 3-3. Perform preliminary setup of AN/APM-239A described in 3-1f above.
- e. Set AN/APM-239A TRANSPONDER SET CONTROL MASTER switch to NORM.
- f. Observe pulses from AN/APM-305A DEMOD VID OUT on oscilloscope B INPUT. Adjust AN/APM-305A DEMOD VID LEVEL and oscilloscope controls until reply pulse amplitude is 1.0 volt.
- g. Record AN/APM-305A MEASUREMENT meter indication in dbw; add the cable loss from transponder to AN/APM-305A. The sum shall equal  $27 \pm 3$  dbw and no more than 1db difference between F1 and F2 (fig. 3-3A).
- h. Set AN/APM-305A MEASUREMENT FUNCTION SELECT to FREQ. SIG GEN FUNCTION to SWP  $\pm 20$  MHz and SCOPE TRIG/FREQ MEAS DELAY (USEC) to X400. Use scope MIXED TIME/DIV DLY to adjust markers for convenient viewing, and adjust AN/APM-305A SCOPE TRIG/FREQ MEAS DELAY (USEC) MULT for a peak pulse on the scope. Determine the frequency using the markers (fig. 3-2). Frequency should be  $1090 \pm$  MHz.

Figure 3-2 (2) deleted.

### 3-4. Transponder Reply Code Characteristics Performance Test

Perform the following steps in measurement of reply code pulse characteristics.

- a. Connect equipment as shown in figure 3-1, except remove scope TRIG OUT from AN/APM-305A

and connect to AN/APM-239A SUPPRESSION out. Basic mode switches up.

- b. Set and adjust oscilloscope controls as listed in table 3-1 except: MAIN TIME/DIV to .5 USEC.

- c. Set and adjust AN/APM-305A controls as listed in table 3-2, except: MEASUREMENT FUNCTION SELECT to PRF REPLY.

- d. Set and adjust AN/APM-239A controls as described in table 3-3. Perform preliminary adjustments of 3-1f above. Set AN/APM-239A TRANSPONDER SET CONTROL MASTER switch to NORM.

- e. Set and adjust AN/APM-305A CHAL MODE SELECT switch to 1 and adjust scope MAIN TIME/DIV control to read pulse width and duration.

- f. Locate first reply pulse (F1, fig. 3-3A) and measure pulse rise time, fall time, and pulse width. (Note: Pulse rise and fall time is measured between the 10% and 90% points, and pulse width at the 50% point.) Readings should be:

RISE TIME = 0.05 to 0.15 usec.

FALL TIME = 0.05 to 0.20 usec.

PULSE WIDTH =  $0.45 \pm 0.10$  usec.

- g. Check frame spacing by adjusting scope TIME/DIV and DELAY functions to view the markers from the AN/APM-305A MKRS OUT jack on CHANNEL A, and the F1-F2 reply pulses (fig. 3-3A) from the DEMOD VID OUT jack on CHANNEL B. Use the MRK PHASING control on the AN/APM-305A to align the leading edge of the F1 pulse with the leading edge of the first marker. Turn DELAY knob on scope to F2 pulse. The leading edge of the F2 pulse should be aligned with the leading edge of the second marker. Frame Spacing =  $20.3 \pm 0.05$  usec.

- h. Set AN/APM-305A CHAL MODE SELECT switch to 2. Use the MRK PHASING control on the AN/APM-305A to align the leading edge of the F1 pulse with the leading edge of the first marker. Turn DELAY knob on scope to the third marker. Actuate IDENT switch (identification marker) on the AN/APM-239A control head. The IDENT pulse should appear with the leading edge of the IDENT pulse aligned with the leading edge of the third marker ( $24.65 \pm 0.5$  usec). The IDENT pulse should last 15-30 seconds.

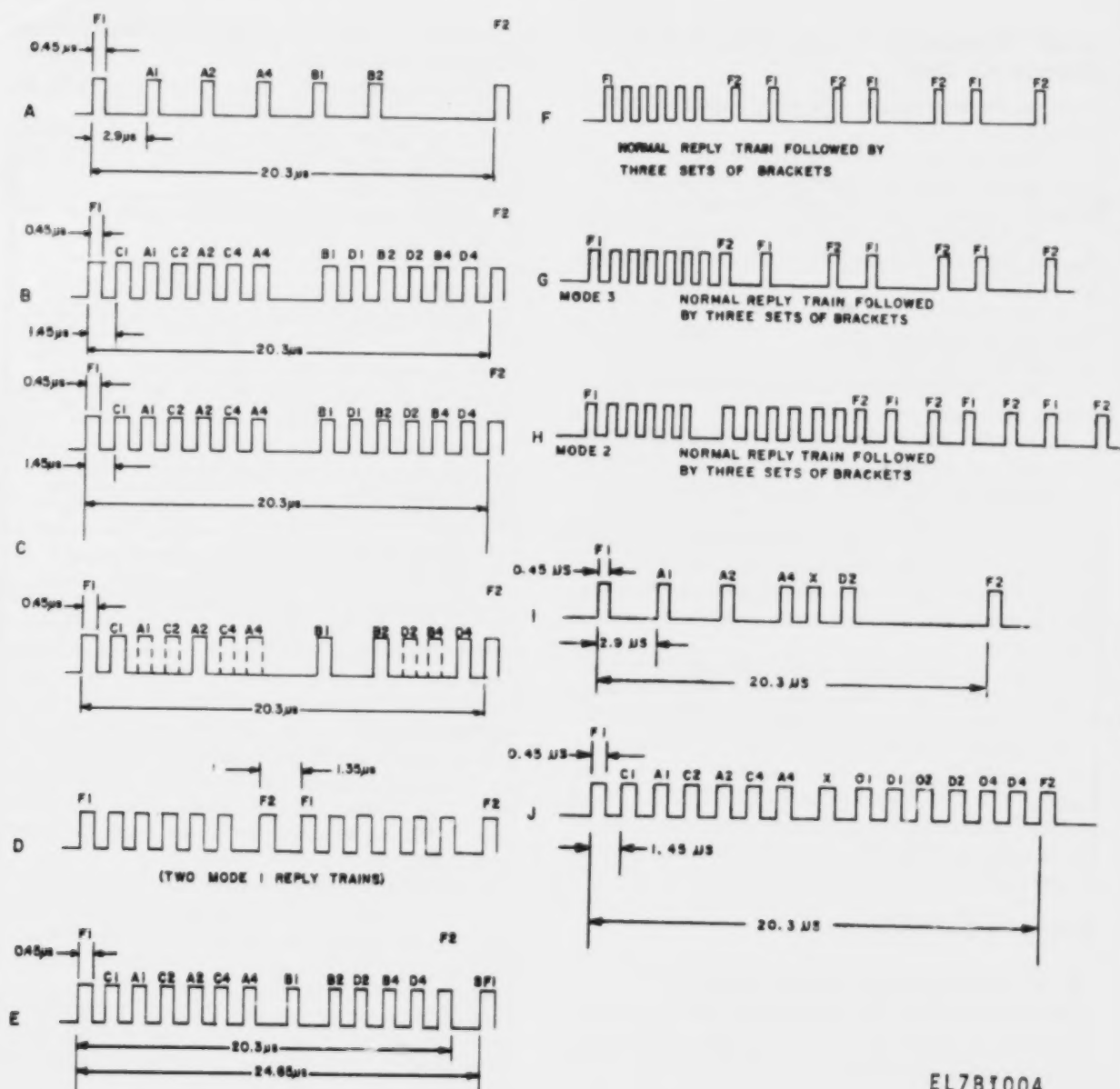


Figure 3-3. Normal Reply Pulse Trains.

EL7B1004

### 3-5. Transponder Decoding Characteristics Performance Test

Perform the following steps to test transponder interrogation decoding characteristics.

- Connect equipment as shown in figure 3-1.
- Set and adjust oscilloscope controls as shown in table 3-1, except as follows:

| Control       | Position |
|---------------|----------|
| MAIN TIME/DIV | 10 μSEC  |

### 3-6 Change 1

- Set AN/APM-305A controls as listed in table 3-2.
- Set AN/APM-239A controls as listed in table 3-3. Perform preliminary setup of AN/APM-239A as described in 3-1f above.

e. Set AN/APM-239A TRANSPONDER SET CONTROL MASTER switch to normal and adjust AN/APM-305A MEASUREMENT DEMOD VID LEVEL for a 1-V peak presentation on oscilloscope CHANNEL B.



f. Observe reply pulses on oscilloscope B input and check for proper pulse sequence as per table 3-4 and figure 3-3.

g. Set AN/APM-305A MAIN ATTEN to -50, then adjust CHAL WIDTH SELECT switch to 0.25, 0.50, 0.80 and 1.70. Note: Reply Pulse appears only on 0.80.

h. Set AN/APM-305A CHAL WIDTH SELECT switch to 0.80 and set CHAL SUB PULSE POSITION switch to -.9, -.2, 0, +.2, +.9. Note: Reply Pulses appear on -.2, 0, +.2.

i. Set AN/APM-305A CHAL MODE SELECT switch to 4A, and CHAL WIDTH SELECT to 0.50. Next set CHAL SUB PULSE POSITION switch to -.9, -.2, 0, +.2, +.9. Note: Reply Pulses appear on -.2, 0, +.2.

j. Set AN/APM-305A CHAL MODE SELECT switch to TEST and CHAL SUB PULSE to 0.

k. Hold RAD TEST switch, on the AN/APM-239A CONTROL in the RAD TEST position. A full mode 3/A reply should be present on the B input of the oscilloscope (fig. 3-3[B]).

Table 3-4. Transponder Reply Code Characteristics

| AN/APM-239A<br>Control/Setting                           | AN/APM-305A<br>Control Setting | Oscilloscope<br>TIME/DIV<br>Setting | Oscilloscope B<br>INPUT Waveforms<br>(fig. 3-3) |
|----------------------------------------------------------|--------------------------------|-------------------------------------|-------------------------------------------------|
| MASTER-NORM                                              | CHAL                           | 5 $\mu$ SEC                         | A                                               |
| MASTER-NORM                                              | MODE SELECT-1                  |                                     |                                                 |
| MASTER-NORM                                              | MODE SELECT-2                  | 5 $\mu$ SEC                         | B                                               |
| MASTER-NORM                                              | MODE SELECT-3/A                | 5 $\mu$ SEC                         | B                                               |
| MASTER-NORM                                              | MODE SELECT-C                  | 5 $\mu$ SEC                         | C                                               |
| MASTER-NORM                                              | MODE SELECT-1                  | 5 $\mu$ SEC                         | D                                               |
| IDENT/OUT/MIC to IDENT<br>(pulse remains for 20 seconds) |                                |                                     |                                                 |
| MASTER-NORM                                              | MODE SELECT-2                  | 5 $\mu$ SEC                         | E                                               |
| IDENT/OUT/MIC to IDENT<br>(pulse remains for 20 seconds) |                                |                                     |                                                 |
| MASTER-NORM                                              | MODE SELECT-3/A                | 5 $\mu$ SEC                         | E                                               |
| IDENT/OUT/MIC to IDENT                                   | MODE SELECT-C                  | 10 $\mu$ SEC                        | C                                               |
| MASTER-EMER                                              | MODE SELECT-1                  | 10 $\mu$ SEC                        | F                                               |
| IDENT/OUT/MIC to OUT                                     |                                |                                     |                                                 |
| MASTER-EMER                                              | MODE SELECT-2                  | 10 $\mu$ SEC                        | G                                               |
| MASTER-EMER                                              | MODE SELECT-3/A                | 10 $\mu$ SEC                        | H                                               |
| MASTER-EMER                                              | MODE SELECT-3/C                | 20 $\mu$ SEC                        | C                                               |
| MASTER-NORM-X-P                                          | MODE SELECT-1f                 | 10 $\mu$ SEC                        | I                                               |
| MASTER-NORM-X-P                                          | MODE SELECT-2                  | 10 $\mu$ SEC                        | J                                               |
| MASTER-NORM-X-P                                          | MODE SELECT-3/A                | 10 $\mu$ SEC                        | J                                               |
| MASTER-NORM-X-P                                          | MODE SELECT-C                  | 10 $\mu$ SEC                        | C                                               |

### 3-6. Transponder Automatic Overload Cutoff (AOC) Performance Test

Perform the following steps to test transponder AOC:

a. Connect equipment as shown in figure 3-1.

b. Set and adjust oscilloscope controls as listed in table 3-1, except as follows:

| Control       | Position     |
|---------------|--------------|
| MAIN TIME/DIV | 20 $\mu$ SEC |

#### NOTE

Signal is more easily viewed by adjusting DIV DELAY.

c. Set and adjust AN/APM-305A controls as listed in table 3-2, except as follows:

| Control         | Position |
|-----------------|----------|
| MEASUREMENT     |          |
| FUNCTION SELECT | PRF CHAL |
| PRF RANGE       | X1K      |
| PRF SELECT      | X1K      |
| PRF MULT        | 1.0      |

d. Set and adjust AN/APM-239A controls as listed in table 3-3. Perform preliminary adjustment of 3-1f above.

e. Set AN/APM-239A TRANSPONDER SET CONTROL MASTER switch to NORM and adjust AN/APM-305A MAIN ATTEN CONTROL for minimum Transponder Sensitivity Level (MTL) recorded in paragraph 3-2h. Decrease amount of attenuation by 3 db.

f. While observing electronic counter and AN/APM-305A MEASUREMENT meter, increase setting of PRF SELECT MULT CONTROL until A.O.C. limiting threshold occurs. Electronic counter indication should be  $1200 \pm 100$  PRF.

g. Adjust AN/APM-305A MAIN ATTEN control from 3 to 50 db above MTL to Test A.O.C. range. Electronic counter indication should maintain A.O.C. limiting of  $1200 \pm 100$  PRF.

h. Repeat steps f and g above for Modes 2, 3/A and C.

### 3-7. Transponder ISLS Performance Test

Perform the following steps to test transponder ISLS characteristics:

- a. Connect equipment as shown in figure 3-1.
- b. Set and adjust oscilloscope controls as shown in table 3-1, except as follows:

| Control       | Position     |
|---------------|--------------|
| MAIN TIME/DIV | 10 $\mu$ SEC |

- c. Set AN/APM-305A controls as listed in table 3-2, except set AUX ATTEN control to ISLS-O.
- d. Set AN/APM-239A controls as listed in table 3-3. Perform preliminary setup of AN/APM-239A described in 3-1f above.
- e. Set AN/APM-239A TRANSPONDER SET CONTROL MASTER switch to NORM.
- f. Observe reply pulses on oscilloscope B INPUT.
- g. Set AN/APM-305A CHAL INHIB switch to ISLS ON. Note that reply pulses disappear on oscilloscope. "Leave ISLS ON".
- h. Set AN/APM-305A CHAL ISLS SPACING SELECT switch to -.60, -.15, 0, +.15, and +.60. Reply pulses appear only on -.60.
- i. Set AN/APM-305A CHAL MODE SELECT switch to 2, 3/A and C. ISLS SPACING SELECT switch to -.60, -.15, 0, +.15, and +.60. Reply pulses appear only on -.60 and +.60. (Reset ISLS SPACING SELECT switch to 0.)
- j. Set AN/APM-305A CHAL MODE SELECT switch to 2 and adjust MAIN ATTEN control from 3 to 50 db above (M.T.L.). Electronic counter shall not indicate more than five replies.
- k. Adjust AUX ATTEN control from (0) to (-9) on ISLS indicator. Note that replies are enabled.
- l. Adjust AN/APM-305A MAIN ATTEN from 3 to 50 db above (M.T.L.). Replies are enabled throughout entire range.

### 3-8. Transponder Disparity Performance Test

Perform the following steps to test transponder disparity characteristics:

- a. Connect equipment as shown in figure 3-1.
- b. Set and adjust oscilloscope controls as listed in table 3-1, except as follows:

| Control       | Position     |
|---------------|--------------|
| MAIN TIME/DIV | 50 $\mu$ SEC |

- c. Set AN/APM-305A controls as listed in table 3-2, except set CHAL MODE SELECT switch to 4A, SCOPE TRIG/FREQ MEAS DELAYRANGE to X4 and MULT to 5 and CHAL width to .5.
- d. Set AN/APM-239A controls as listed in table 3-3. Perform preliminary setup on AN/APM-239A as described in 3-1f above.

- e. Set AN/APM-239A TRANSPONDER SET CONTROL MASTER switch to NORM.

f. Observe reply pulses on oscilloscope B INPUT. The three pulse reply is generated by the test set in response to the mode 4 enable signal of the transponder.

- g. Observe that AN/APM-239A TRANSPONDER SET CONTROL REPLY indicator is lit.

h. Set AN/APM-305A CHAL MODE SELECT switch to TEST and note interval of time between setting of switch and when AN/APM-239A REPLY indicator extinguishes. Delay shall be 2 to 5 sec. This checks the characteristics of REPLY indicator circuits.

- i. Set AN/APM-305A CHAL MODE SELECT switch to 4A.

j. Set AN/APM-239A MODE 4 REPLY switch to INTERRUPT. Note that MODE 4 CAUTION indicator lights and reply pulses disappear on oscilloscope.

k. Set AN/APM-239A MODE 4 REPLY switch to REPLY and note interval before MODE 4 CAUTION indicator extinguishes. Delay shall be 2 to 5 sec. This checks characteristics of MODE 4 CAUTION indicator.

l. Set AN/APM-305A CHAL INHIB switch to ISLS ON. Observe reply pulses disappear on oscilloscope and after time interval AN/APM-239A TRANSPONDER SET CONTROL REPLY indicator extinguishes.

m. Set AN/APM-239A MODE 4 DISPARITY switch to INTERRUPT. NOTE MODE 4 CAUTION indicator illuminates.

n. Set AN/APM-239A MODE 4 DISPARITY switch to DISPARITY. Observe after time interval MODE 4 CAUTION indicator extinguishes.

o. Press and hold AN/APM-305A CHAL INHIB switch to DISPARITY (MOM). Set AN/APM-239A MODE 4 DISPARITY to INTERRUPT. Observe that AN/APM-239A MODE 4 CAUTION indicator lights and after time interval TRANSPONDER SET CONTROL REPLY indicator extinguishes.

p. Release AN/APM-305A CHAL INHIB switch and return AN/APM-239A MODE 4 DISPARITY switch to DISPARITY.

q. Decrease settings of AN/APM-305A PRF SELECT controls until AN/APM-239A REPLY indicator extinguishes. The AN/APM-305A MEASUREMENT meter now indicates the threshold of the REPLY indicator in PRF.

r. Connect coax cable from the interrog jack on the AN/APM-239 to CH A of the oscilloscope. Adjust TIME/DIV to read the pulse width and the amplitude of the first pulse. Pulse width = .4 to .6  $\mu$ SEC and the amplitude = 1.5 to 5V.

s. Disconnect cable from INTERROG jack of AN/APM-239A and connect it to the AUDIO jack on the

AN/APM-239A. Put AUDIO/LIGHT switch on the control head of the AN/APM-239A to the AUDIO position, adjust scope TIME/DIV to measure the AUDIO pulse. Should be NLT 500 $\mu$ SEC on the negative portion.

t. Put AUDIO/LIGHT switch on the AN/APM-239A, CONTROL HEAD to the LIGHT position. On the AN/APM-305A, put the measurement PRF RANGE switch to the X1K position.

Set the FUNCTION SELECT switch to the PRF REPLY position. Turn PRF SELECT MULTIPLIER knob counterclockwise to 1. Put the PRF SELECT RANGE switch to the 1K. Adjust the PRF SELECT MULTIPLIER clockwise until limiting action occurs. (Generally limiting action occurs around 2500). The REPLY measurement meter should read 1500 to 2500 PRF.

### 3-9. Transponder Receiver Dead Time Performance Test

Perform the following steps to test transponder receiver dead time characteristics:

a. Connect equipment as shown in figure 3-1.

b. Set and adjust oscilloscope controls as listed in table 3-1 except as follows:

| Control       | Position     |
|---------------|--------------|
| MAIN TIME/DIV | 50 $\mu$ SEC |

c. Set and adjust AN/APM-305A controls as listed in table 3-2 except as follows:

| Control              | Position |
|----------------------|----------|
| CHAL MODE SELECT     | DUAL 3/A |
| SCOPE TRIG/FREQ MEAS |          |
| DELAY (USEC) RANGE   | X40      |
| SCOPE TRIG/FREQ MEAS |          |
| DELAY (USEC) MULT    | 5        |

d. Set and adjust AN/APM-239A as listed in table 3-3. Perform step 3-1f. Set AN/APM-239A TRANSPONDER SET CONTROL MASTER switch to NORM.

e. Observe that two sets of mode 3/A reply pulses are displayed on oscilloscope (table 3-4).

f. Decrease setting of AN/APM-305A SCOPE TRIG/FREQ MEAS DELAY (USEC) MULT control until second set of reply pulses just disappear. Increase setting of control until pulses just reappear.

g. Set oscilloscope MAIN TIME/DIV switch to 20  $\mu$ SEC and measure spacing from leading edge of first reply F2 pulse to leading edge of first pulse of second challenge. The spacing shall be 75 to 100  $\mu$ SEC.

### 3-10. Transponder Suppression Pulse Performance Test

Perform the following steps to test transponder suppression pulse characteristics.

a. Connect equipment as shown in figure 3-1 except connect oscilloscope A INPUT (unterminated) to AN/APM-239A SUPPRESSION OUT jack.

b. Set and adjust oscilloscope controls as listed in table 3-1, except as follows:

| Control       | Position     |
|---------------|--------------|
| MAIN TIME/DIV | 20 $\mu$ SEC |
| A VOLTS/DIV   | 5            |
| DISPLAY       | ALT          |

c. Set and adjust AN/APM-239A controls as listed in table 3-2.

d. Set and adjust AN/APM-239A controls as listed in table 3-3. Perform preliminary adjustment of 3-1f (1) through (3) above.

e. Set AN/APM-239A TRANSPONDER SET CONTROL MASTER switch to NORM.

f. Observe reply pulses and transponder suppression pulse on oscilloscope. Oscilloscope A INPUT displays transponder suppression pulse and its characteristics. The suppression pulse reaches a minimum of 18 volts by the time F1 reaches 10% of its amplitude and remains at 18 volts or greater until the F2 pulse has decayed to the 10% level, and that the suppression level is less than 5 volts, 5  $\mu$ SEC after the F2 pulse decays to the 10% level.

g. Set AN/APM-305A SUPPR switch to ON. Reply pulses and transponder suppression pulse should disappear. This checks the operation of the transponder when an external suppression pulse is applied.

### 3-11. General Troubleshooting

The direct and general support or aviation intermediate maintenance (AVIM) and depot maintenance procedures in this manual supplement the procedures described in TM 11-5895-490-20 and TM 11-5895-490-35. The systematic troubleshooting procedure, which begins with the operation checks that can be performed at organizational level, is prepared for a higher level of maintenance in this technical manual. Sectionalizing, localizing, and isolating techniques and test equipment used in the troubleshooting procedure are more complex.

### 3-12. System Troubleshooting

Performance of system troubleshooting procedures requires access to the test points on the power supply and other subassemblies of the RT-859A/APX-72. This requires depressurization and disassembly para 3-15) of the RT-859A/APX-72 and use of jumper type test cable assemblies supplied with AN/APM-239A. To troubleshoot the set using the AN/APM-305A test set and associated equipment first follow the test setup procedure in paragraph a below. After the



initial setups are made troubleshooting is then performed using the procedures stated in paragraph *b* below.

#### WARNING

Lethal voltages are present when power is applied to the test setup. These dangerous voltages are present at exposed points identified by red cables and pins which indicate 1000 vdc connections.

*a. Bench Test Setup.* To prepare the RT-859A/APX-72 and associated test equipment for troubleshooting procedures using the AN/APM-305A test set assemble the equipment as illustrated in figure 3-1 and proceed as follows:

#### CAUTION

Make sure AN/APM-239A TRANSPONDER SET CONTROL MASTER switch is set to OFF before applying power to AN/APM-239A.

(1) Apply power to test equipment; allow 10 minute warmup.

(2) Set and adjust oscilloscope controls as listed in table 3-1.

(3) Set and adjust AN/APM-305A controls as listed in table 3-2.

(4) Set and adjust AN/APM-239A controls as listed in table 3-3.

(5) Be sure circuitboard assemblies are inserted in assigned chassis connectors by checking color coding and key alignment.

(6) Be sure circuitboard assemblies are properly seated to make good clerical contact.

*b. Measure power supply voltages as directed in table 3-5.*

*c. Enter column titled Symptoms in table 3-6 and select the symptom that describes the condition of the RT-859A/APX-72 power supply being tested.*

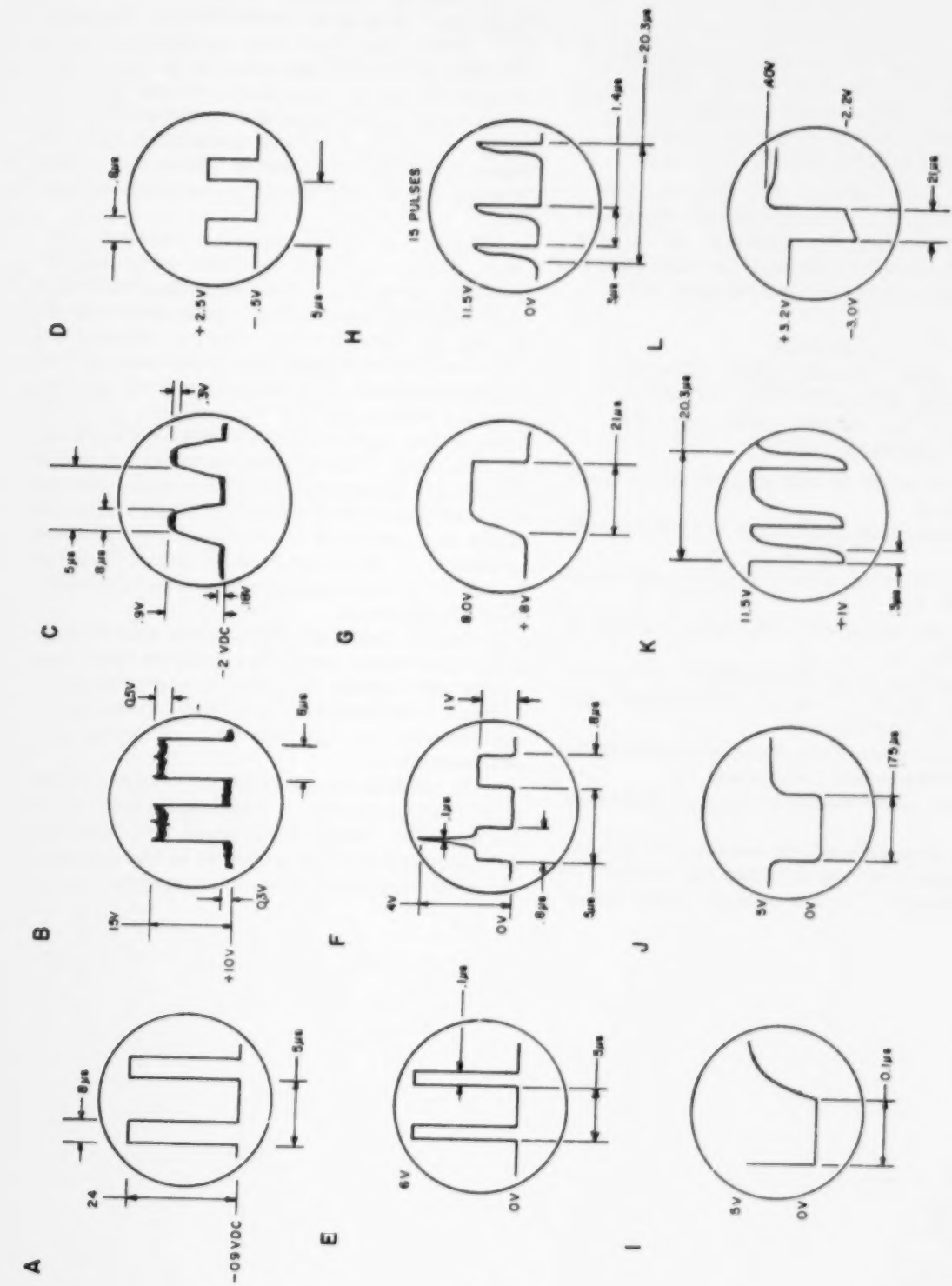
Perform the indicated troubleshooting procedures listed in the action column.

(1) *Use of symptom troubleshooting chart.* Table 3-6 is divided into three columns. The symptom which describes the condition of the RT-859A/APX-72 being tested is in column one. Adjacent to the symptom in the second column is listed one or more causes that would produce this symptom. For each probable cause listed a parallel course of action is described in column three which when performed will correct the equipment malfunction.

(2) *Use of comprehensive troubleshooting chart.* Tables 3-7 and 3-8 are comprehensive troubleshooting charts designed to localize trouble to a circuit board or component subassembly by observing the waveform structure at selected test points as shown in figure 3-4. To use table 3-7 set up test equipment as shown in figure 3-1 and 3-5, selecting settings for mode 2 operation. Apply the interrogation signal to the RT-859A/APX-72 and the test probe of the oscilloscope to the test points in table 3-7 in sequence. If the waveform observed is correct proceed in the direction of the YES arrow to the next test point. If the waveform is incorrect proceed in the direction of the NO arrow. Table 3-8 is used in the same manner as above using a mode 4 interrogation pulse.

*d. Replace suspected subassembly with a known good replacement; return test setup to operational status; and recheck waveform at same test point. (Adhere to the foregoing CAUTION on removal and replacement of circuitboard or component subassemblies.)*

*e. Reassemble the RT-859A/APX-72.* Apply heat sink compound (as directed) and return for checkout testing. The faulty circuitboard or component subassemblies shall be subjected to the subassembly troubleshooting procedures of paragraph 3-14.



EL7BI001

Figure 3-4. Normal Waveforms for Troubleshooting

Table 3-5. Power Supply Voltages

| Step | Procedure                                                                                                                                                                                                        | Measure                                  |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| 1    | Refer to figure 3-1 and 3-5, place AN/APM-239 TRANSPONDER PWR INPUT to DC only, meter selection to DC, and adjust DC output control for 27.5 vdc.                                                                |                                          |
| 2    | Connect negative lead of multi-meter to TP2(+6.3V RET) and positive lead to TP3(+6.3 VDC).                                                                                                                       | 6.3±0.19 vdc                             |
| 3    | Disconnect multimeter leads. Connect negative to TL1 (GRD) and positive lead to (+6.3 VDC).                                                                                                                      | 6.3±0.19 vdc                             |
| 4    | Disconnect positive lead from TP3(+6.3 VDC) and connect to TP4(+ VDC).                                                                                                                                           | 6.0±0.18 vdc                             |
| 5    | Disconnect positive lead from TP4(+6 VDC) and connect to TP5(+12 VDC).                                                                                                                                           | 12.0±0.36 vdc                            |
| 6    | Disconnect positive lead from TP5(+12 VDC) and connect to TP6(+25 VDC).                                                                                                                                          | 25.0±0.75 vdc                            |
| 7    | Disconnect positive lead from TP6(+25 VDC) and connect to TP7(-6 VDC).                                                                                                                                           | -6.0±0.18 vdc                            |
| 8    | Disconnect positive lead from TP7(-6 VDC) and connect to TP8(-80 VDC).                                                                                                                                           | -80±2.4 vdc                              |
| 9    | Disconnect positive lead from TP8(-80 VDC) and connect to TP9(-110 VDC).                                                                                                                                         | -110 to -115.5 vdc<br>(-110 vdc nominal) |
| 10   | Disconnect positive lead from TP9(-110 VDC) and connect to TP10 1000 VDC +100                                                                                                                                    | 9.6 vdc                                  |
| 11   | Disconnect positive and negative leads from power supply. Place AN/APM-239 Transponder PWR INPUT to <u>AC/DC</u> METER SELECTION to AC and adjust AC OUTPUT DC CONTROL FOR 115 volts. Repeat steps 2 through 10. |                                          |

Table 3-6. System Troubleshooting Chart

| Symptom                                                                          | Probable Cause                          | Action                                                                                                                                                                                                                                                                                                                            |
|----------------------------------------------------------------------------------|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. No replies any mode.                                                          | a. Power supply failure.                | Measure power supply voltage as directed in table 3-5. Replace power supply, if defective, and repeat measurement procedures. Perform comprehensive troubleshooting procedures of table 3-7 to isolate trouble. Replace defective subassembly and repeat test procedures.                                                         |
|                                                                                  | b. Circuit failure.                     | Perform comprehensive troubleshooting procedures of table 3-7, steps 5 through 10. Replace defective subassembly and repeat test procedures.                                                                                                                                                                                      |
| 2. No replies in modes 1, 2, 3/A test and C. Mode 4 replies correct.             | Circuit failure.                        | Perform comprehensive troubleshooting procedures of table 3-7, steps 5 through 10. Replace defective subassembly and repeat test procedures.                                                                                                                                                                                      |
| 3. No replies in mode 4. Modes 1, 2, 3/A, test and C correct.                    | Circuit failure.                        | Perform comprehensive troubleshooting procedures of table 3-8. Replace defective subassembly and repeat test procedures.                                                                                                                                                                                                          |
| 4. Incorrect replies in modes 1, 2, 3/A test and C. Mode 4 replies correct.      | a. Encoder control failure.             | Change mode of operation and in interrogation from mode 2 to mode 3/A. If mode 3/A replies are correct, replace encoder control circuitboard.                                                                                                                                                                                     |
|                                                                                  | b. Encoder clock failure.               | If mode 3/A replies are incorrect in item 4a above, replace encoder clock circuitboard.                                                                                                                                                                                                                                           |
|                                                                                  | c. Encoder grating failure.             | If replies in item 4b above are still incorrect, replace encoder circuitboard and repeat mode 2 and 3/A tests. If replies are correct, original encoder grating circuitboard is malfunctioning.                                                                                                                                   |
|                                                                                  | d. Internal or external wiring failure. | If results of tests in items 4a, b, and c above are negative, check internal and external wiring.                                                                                                                                                                                                                                 |
| 5. Incorrect or no replies in emergency failure operation in modes 1, 2, or 3/A. | a. Encoder grating.                     | Observe waveforms at test points A6TP1 and A6TP5 on the encoder grating circuitboard and A5TP1, A5TP6, and A5TP9 on the encoder control circuitboard. If incorrect waveforms are observed, replace encoder grating circuitboard and repeat test procedures. If correct waveforms were originally observed, proceed to 5b.         |
|                                                                                  | b. Encoder control failure.             | Replace encoder control circuitboard and observe waveform at testpoint A4TP1 on encoder clock circuitboard. If correct, original control circuitboard is malfunctioning. If incorrect, proceed to item 5b.                                                                                                                        |
|                                                                                  | c. Encoder clock failure.               | Replace encoder control circuit board and observe waveform at test point A4TP1 on encoder clock circuitboard. If correct, original encoder control circuitboard is malfunctioning. If incorrect, check internal and external wiring.                                                                                              |
| 6. Incorrect or no replies in I/P operation in modes 1, 2, or 3/A.               | a. Encoder gating failure.              | Observe waveforms at test points A6TP3, A6TP9, and A6TP5 on the encoder gating circuitboard and test points A4TP6 and A4TP7 on the encoder clock circuitboard. If incorrect waveforms are observed, replace encoder gating circuitboard and repeat test procedures. If correct waveforms were originally observed, proceed to 6b. |
|                                                                                  | b. Encoder clock failure.               | Replace encoder clock circuitboard and observe waveform at test point A4TP4 on encoder clock circuitboard. If correct, original encoder clock circuitboard is malfunctioning. If incorrect check internal and external wiring.                                                                                                    |

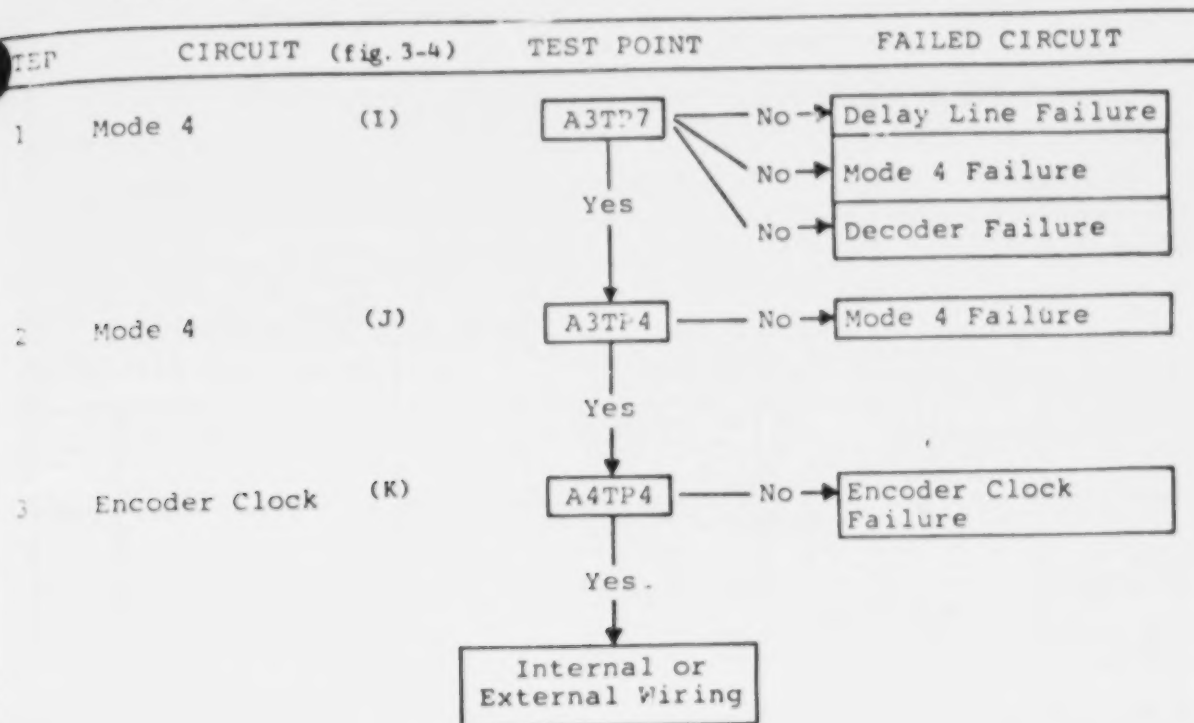
# NOTE

Waveforms for test points in Tables 3-7 and 3-8 are shown in figure 3-4.

Table 3-7 Modes 1, 2, 3/A, Test, and C Troubleshooting Chart

| STEP                            | CIRCUIT (fig 3-4) | TEST POINT                  | FAILED CIRCUIT                                                        |
|---------------------------------|-------------------|-----------------------------|-----------------------------------------------------------------------|
| 1. Detector and Video Amplifier | (A)               | AR3TP1                      | No → Receiver Z1/AR1 Failure                                          |
|                                 |                   | Yes                         |                                                                       |
| 2. Detector and Video Amplifier | (B)               | AR3TP4<br>AR3J1             | No → Video Amplifier Failure                                          |
|                                 |                   | Yes                         |                                                                       |
| 3. Processor                    | (C)               | A1TP6                       | No → Video X7 Amplifier Failure                                       |
|                                 |                   | Yes                         |                                                                       |
| 4. Processor                    | (D)               | A1TP2                       | No → Processor Circuit-board Failure in Area of Integrated Circuit A1 |
|                                 |                   | Yes                         |                                                                       |
| 5. Decoder/Delay Line           | (E)               | A2TP7                       | No → Delay Line Failure of 1.5 usec Section                           |
|                                 |                   | Yes                         |                                                                       |
| 6. Decoder                      | (F)               | A2TP4                       | No → Decoder Circuitboard Failure                                     |
|                                 |                   | Yes                         |                                                                       |
| 7. Encoder Clock                | (G)               | A4TP3                       | No → Clock Circuitboard Failure                                       |
|                                 |                   | Yes                         |                                                                       |
| 8. Encoder Clock                | (H)               | A4TP6                       | No → Clock Circuitboard Failure                                       |
|                                 |                   | Yes                         |                                                                       |
| 9. Encoder Clock/Gating (L)     |                   | A6TP5                       | No → Gating Circuitboard Failure<br>Clock Circuitboard Failure        |
|                                 |                   | Yes                         |                                                                       |
| 10. Encoder Clock               | (K)               | A4TP4                       | No → Clock Circuitboard Failure                                       |
|                                 |                   | Yes                         |                                                                       |
| 11. RF Unit                     |                   | Modulator A7 or Transmitter |                                                                       |

Table 3-8. Mode 4 Troubleshooting Chart



### 3-13. Subassembly Troubleshooting

For troubleshooting purposes, the RT-859A/APX-72 subassemblies are divided into three categories: (1) removable circuit board subassemblies which require the use of extender boards for in-circuit troubleshooting, (2) circuitboard and component subassemblies which can be inspected without removal from the circuit, and (3) circuitboard and component subassemblies which must be removed from circuit for troubleshooting. General troubleshooting procedures include referring to applicable wiring diagrams for component location, pin numbering, and general orientation, observing waveforms at test points and comparing them with those shown in table comparing pin voltage measurements with standards shown in FO-1. Functional troubleshooting tables 3-10 through 3-12 are presented for circuitboard and power supply subassemblies.

a. *Extender Board Procedure.* The removable circuitboard subassembly is prepared for

troubleshooting by mounting it in applicable extender board listed in table 3-9. The circuitboard and extender board is then substituted in the applicable chassis connector of a known serviceable RT-859A/APX-72 establishing the basis that all inputs to the malfunctioning circuitboard are normal. The test set-up used is shown in figure 3-1 and described in paragraph 3-10. Functional troubleshooting table describes the troubleshooting procedures for the removable circuitboard subassemblies.

Table 3-9. Extender Boards Reference

| RT-859A/APX-72 circuit boards | Type   | Corresponding extenderboard |
|-------------------------------|--------|-----------------------------|
| A1 Processor                  | 44 Pin | MX-8203/APM-239A (A1)       |
| A2 Decoder                    | 66 Pin | MX-8207/APM-239A (A2)       |
| A3 Mode 4                     | 44 Pin | MX-8202/APM-239A (A3)       |
| A4 Encoder Clock              | 44 Pin | MX-8205/APM-239A (A4)       |
| A5 Encoder Control            | 66 Pin | MX-8206/APM-239A (A5)       |
| A6 Encoder Gating             | 44 Pin | MX-8204/APM-239A (A6)       |



Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure

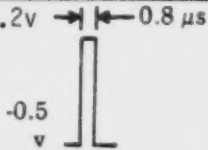
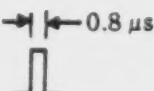
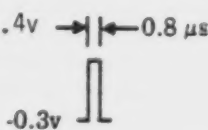
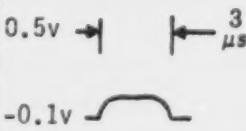
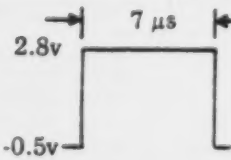
| CIRCUIT CARD: Processor (A1) (RT-859A/APX-72) |         |                                                                                     |                                                                                    |                                                                     |
|-----------------------------------------------|---------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| STEP                                          | MEASURE | SIGNAL                                                                              | ABNORMAL INDICATION                                                                | NORMAL INDICATION                                                   |
| FUNCTION/SYMPTOM: No Output TP1               |         |                                                                                     | OPERATIONS: Mode C, Code 0000, MASTER to STBY, MTL-87 dBv                          |                                                                     |
| 1                                             | AlTP2   |    | No signal.<br>Go to step 2.                                                        | Go to step 5.                                                       |
| 2                                             | AlTP3   |    | No signal.<br>Go to step 3.                                                        | Go to step 4.                                                       |
| 3                                             | AlTP6   |  | No signal.<br>Check A1, Q1, and associated circuitry.                              | Check DL1, CR3, and CR4.                                            |
| 4                                             | AlTP4   |  | No signal.<br>Check A2, Q2, Q5, Q6, Q9 through Q14, Q31, and associated circuitry. | Signal normal and TP3 > TP4 in relative voltage<br>Check A3 and A5. |
| 5                                             | AlTP5   |  | No signal.<br>Go to step 6.                                                        | Go to step 8.                                                       |



Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

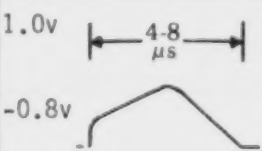
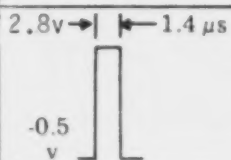
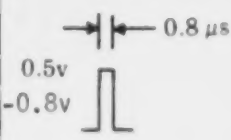
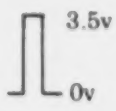
| CIRCUIT CARD: Processor (A1) (RT-859A/APX-72) - Continued |         |                                                                                     |                                                                                        |                                                                       |
|-----------------------------------------------------------|---------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| STEP                                                      | MEASURE | SIGNAL                                                                              | ABNORMAL INDICATION                                                                    | NORMAL INDICATION                                                     |
| FUNCTION/SYMPTOM: No Output TP1                           |         |                                                                                     | OPERATIONS: Mode C, Code 0000, MASTER to STBY, MTL-87 dbv                              |                                                                       |
| 6                                                         | A4-12   |    | <p>No signal.</p> <p>Check Q7, Q8, Q12, Q15, and associated circuitry.</p>             | Go to step 7.                                                         |
| 7                                                         | A4-13   |    | <p>Incorrect dc level.</p> <p>Adjust R25; check diodes CR17, CR18, and terminal Y.</p> | <p>Correct level with pin A3-2 &gt; A3-3.</p> <p>Check A4 and A5.</p> |
| 8                                                         | A3-8    |  | <p>No signal.</p> <p>Go to step 9.</p>                                                 | Go to step 10.                                                        |
| 9                                                         | A3-5    |  | <p>No signal.</p> <p>Check CR7 and CR8.</p>                                            | <p>Signal with A2-2 &gt; A1TP4</p> <p>Replace A3.</p>                 |
| 10                                                        | A6-11   |  | <p>No signal.</p> <p>Check appropriate segments of A5, A6, and A7.</p>                 | Go to next sequence of tests.                                         |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

| CIRCUIT CARD: Processor (A1) (RT-859A/APX-72) - Continued |               |                              |                                                               |                                                             |
|-----------------------------------------------------------|---------------|------------------------------|---------------------------------------------------------------|-------------------------------------------------------------|
| STEP                                                      | MEASURE       | SIGNAL                       | ABNORMAL INDICATION                                           | NORMAL INDICATION                                           |
| FUNCTION/SYMPOM:                                          |               | No Output TP1, OPERATIONS:   |                                                               | Mode C, Code 0000,<br>MASTER to STBY,<br>MTL-40 dbv         |
| TP2 OK                                                    |               |                              |                                                               |                                                             |
| 1                                                         | AlTP4         |                              | Incorrect signal.<br>Go to step 2.                            | Go to step 3.                                               |
| 2                                                         | Collector Q28 |                              | No signal.<br>Go to step 3.                                   | Check appropriate parts of A5, A7, CR24, CR25, Q11 and Q12. |
| 3                                                         | AlTP1         |                              | No signal.<br>Check Q29 and Q30.                              | Check Q28, C11, and CR21.                                   |
| FUNCTION/SYMPOM:                                          |               | No Output Terminal 5, TP1 OK |                                                               | Mode C, Code 0000,<br>MASTER to STBY,<br>MTL-40 dBv         |
| OPERATIONS:                                               |               |                              |                                                               |                                                             |
| 1                                                         | Terminal 5    |                              | No signal.<br>Go to step 2.                                   |                                                             |
| 2                                                         | Collector Q21 |                              | No signal.<br>Check Q19, Q20, Q21, CR16, CR23, CR26, and Q17. | Check Q23 and Q24.                                          |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

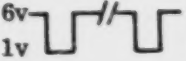
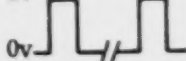
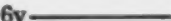
| CIRCUIT CARD: Decoder (A2) |                                                                 |                                                                                                   |                                                                                                                                 |                                                        |
|----------------------------|-----------------------------------------------------------------|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| STEP                       | MEASURE                                                         | SIGNAL                                                                                            | ABNORMAL INDICATION                                                                                                             | NORMAL INDICATION                                      |
| FUNCTION/SYMPOM:           |                                                                 | No Mode<br>Decode Strobe                                                                          | OPERATIONS:                                                                                                                     | Mode 2 and as<br>required Code 7777,<br>MASTER to STBY |
| 1                          | A2TP4<br>or col-<br>lectors<br>of Q2,<br>Q20, Q22,<br>or Q31    | 4v<br><br>0v 1v  | No signal at A2TP4.<br><br>Check collectors of<br>other mode inputs<br>interrogating in<br>corresponding mode.<br>Go to step 2. | Go to step 3.                                          |
| 2                          | Collec-<br>tors Q8,<br>Q1, Q19,<br>Q21, or<br>Q30               | 6v<br>1v<br>     | No signal.<br><br>Replace Q8, Q1,<br>Q19, Q21, or Q30,<br>as applicable.                                                        | Replace Q9, Q2,<br>Q20, Q22, or Q31,<br>as applicable. |
| 3                          | A2TP8                                                           | -6v<br>0v<br>  | No signal in mode<br>being interrogated.<br><br>Go to step 4.                                                                   | Go to step 14.                                         |
| 4                          | A2TP5                                                           | 0.2v<br>0v<br> | 8.0 vdc.<br><br>Go to step 5.                                                                                                   | Go to step 6.                                          |
| 5                          | Collec-<br>tor Q23<br><br>(Momen-<br>tarily<br>ground<br>A2TP5) | 6v<br>0v<br>   | Ground.<br><br>Replace transistor<br>Q23.                                                                                       | Replace transistor<br>Q24.                             |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

| CIRCUIT CARD: Decoder (A2) - Continued |               |                                                                                                  |                                                                  |                                                        |
|----------------------------------------|---------------|--------------------------------------------------------------------------------------------------|------------------------------------------------------------------|--------------------------------------------------------|
| STEP                                   | MEASURE       | SIGNAL                                                                                           | ABNORMAL INDICATION                                              | NORMAL INDICATION                                      |
| FUNCTION/SYMPOM:                       |               | No Mode<br>Decode Strobe                                                                         | OPERATIONS:                                                      | Mode 2 and as<br>required Code 7777,<br>MASTER to STBY |
| 6                                      | A2TP3         | 0.2v <br>0v     | 8.0 vdc.<br>Go to step 7.                                        | Go to step 8.                                          |
| 7                                      | Collector Q42 | 6.4v <br>0v     | 0.2 vdc.<br>Go to step 8.                                        | Replace transistor Q43.                                |
| 8                                      | Base Q42      | 0.7v <br>-1.0v  | Positive vdc.<br>Go to step 9.                                   | Replace transistor Q42.                                |
| 9                                      | A2TP1         | 24v <br>0v    | 24 vdc.<br>Go to step 10.                                        | Go to step 12.                                         |
| 10                                     | Base Q41      | 24.6v <br>0v  | 24 vdc.<br>Go to step 11.                                        | Replace transistor Q41.                                |
| 11                                     | Base Q40      | 25v <br>24.3v | 25 vdc.<br>Replace transistor Q37, capacitor C43, as applicable. | Replace transistor Q40.                                |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

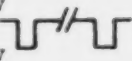
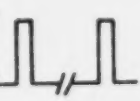
| CIRCUIT CARD: Decoder (A2) - Continued |               |                                                                                                   |                                                              |                                                                                    |
|----------------------------------------|---------------|---------------------------------------------------------------------------------------------------|--------------------------------------------------------------|------------------------------------------------------------------------------------|
| STEP                                   | MEASURE       | SIGNAL                                                                                            | ABNORMAL INDICATION                                          | NORMAL INDICATION                                                                  |
| FUNCTION/SYMPOM:                       |               | No Mode<br>Decode Strobe                                                                          | OPERATIONS:                                                  | Mode 2 and as<br>required Code 7777,<br>MASTER to STBY                             |
| 12                                     | Collector Q26 | 0.2v ———<br>0v                                                                                    | 11.5 vdc.<br>Go to step 13.                                  |                                                                                    |
| 13                                     | Base Q26      | 0.7v <br>-5.0v   | No signal.<br>Replace capacitor<br>C27 or transistor<br>Q25. | Replace transistor<br>Q26.                                                         |
| 14                                     | Base Q32      | 0.7v <br>-0.5v   | No signal.<br>Go to step 15.                                 | Replace transistor<br>Q32.                                                         |
| 15                                     | Collector Q45 | 8v <br>0v      | No signal.<br>Replace transistor<br>Q45.                     | Check diodes CR31,<br>CR32, CR39, resis-<br>tor R108 and re-<br>place as required. |
| 16                                     | A2TP7         | 6v <br>0v      | No signal.<br>Go to step 17.                                 | Replace diodes CR25<br>through CR29 as<br>applicable.                              |
| 17                                     | Base Q33      | 0.7v <br>-4.2v | No signal.<br>Replace transistor<br>Q34.                     | Replace transistor<br>Q33.                                                         |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

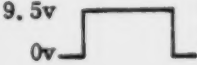
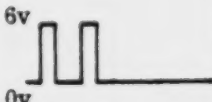
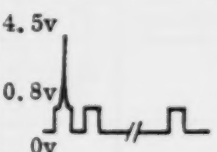
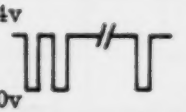
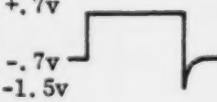
| CIRCUIT CARD: Decoder (A2) - Continued            |               |                                                                                     |                                                                                  |                                                      |
|---------------------------------------------------|---------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|------------------------------------------------------|
| STEP                                              | MEASURE       | SIGNAL                                                                              | ABNORMAL INDICATION                                                              | NORMAL INDICATION                                    |
| FUNCTION/SYMPOTOM: No Suppression With ISLS Input |               |                                                                                     | OPERATIONS: Mode 2, Code 0000, ISLS Pulse, MASTER to NORM                        |                                                      |
| 1                                                 | A2TP5         |    | No signal.<br>Go to step 3.                                                      | Go to step 2.                                        |
| 2                                                 | Collector Q32 |    | No signal.<br>Go to step 3.                                                      | Replace diodes CR40 through CR43 as applicable.      |
| 3                                                 | Collector Q36 |   | No signal.<br>Go to step 4.                                                      | Go to step 5.                                        |
| 4                                                 | Collector Q35 |  | No signal.<br>Replace transistor Q35.                                            | Replace transistor Q36.                              |
| 5                                                 | Base Q23      |  | No signal.<br>Replace diode CR15, capacitor C22, or resistor R66, as applicable. | Replace transistors Q23, Q24, or Q44, as applicable. |



Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

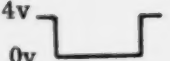
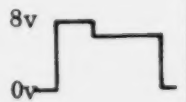
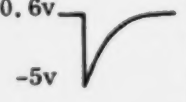
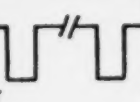
| CIRCUIT CARD: Decoder (A2) - Continued                                                                     |                                        |                                                                                                         |                                                                                            |                                                                             |
|------------------------------------------------------------------------------------------------------------|----------------------------------------|---------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| STEP                                                                                                       | MEASURE                                | SIGNAL                                                                                                  | ABNORMAL INDICATION                                                                        | NORMAL INDICATION                                                           |
| FUNCTION/SYMPTOM:<br>No Generation of<br>Internal Suppression During Replies<br>(Modes 1,2,3/A,C and test) |                                        | OPERATIONS: Mode 2, Code 7777,<br>MASTER to NORM                                                        |                                                                                            |                                                                             |
| 1                                                                                                          | A2TP3                                  | 8v<br>0v               | No signal.<br>Go to step 2.                                                                | Go to step 6.                                                               |
| 2                                                                                                          | Collec-<br>Q42                         | 6.4v<br>0v             | No signal.<br>Go to step 3.                                                                | Replace transistor<br>Q43.                                                  |
| 3                                                                                                          | Junction<br>CR35,<br>CR36, and<br>CR37 | 24v<br>7.0v<br>-0.4v  | No signal.<br>Go to step 4.                                                                | Replace transistor<br>Q42.                                                  |
| 4                                                                                                          | Collec-<br>tor Q26                     | 8v<br>0v             | No signal.<br>Go to step 5.                                                                | Replace diode CR35.                                                         |
| 5                                                                                                          | Base<br>Q26                            | 0.6v<br>-5v          | No signal.<br>Replace transistor<br>Q25, capacitor C27,<br>or diode CR16, as<br>applicable | Replace transistor<br>Q26.                                                  |
| 6                                                                                                          | Base<br>Q32                            | 0.7v<br>-0.5v        | No signal.<br>Replace diode<br>CR32.                                                       | Replace transistor<br>Q32 or diodes CR40<br>through CR43, as<br>applicable. |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

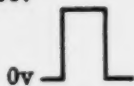
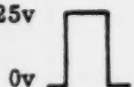
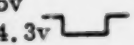
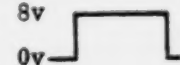
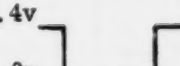
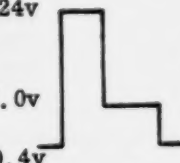
| CIRCUIT CARD: Decoder (A2) - Continued                                                                     |                               |                                                                                                             |                                                  |                                          |
|------------------------------------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------------------------------|--------------------------------------------------|------------------------------------------|
| STEP                                                                                                       | MEASURE                       | SIGNAL                                                                                                      | ABNORMAL INDICATION                              | NORMAL INDICATION                        |
| FUNCTION/SYMPTOM:<br>No Generation of<br>External Suppression During Replies<br>(Modes 1,2,3/A,C and test) |                               |                                                                                                             | OPERATIONS: Mode 2, Code 7777,<br>MASTER to NORM |                                          |
| 1                                                                                                          | A2TP1                         | 24v<br><br>0v              | No signal.<br>Go to step 2.                      |                                          |
| 2                                                                                                          | Collector Q40                 | 25v<br><br>0v              | No signal.<br>Go to step 3.                      | Replace transistor Q41.                  |
| 3                                                                                                          | Base Q40                      | 25v<br>24.3v<br>          | No signal.<br>Replace transistor Q37.            | Replace transistor Q40.                  |
| FUNCTION/SYMPTOM:<br>No Generation of<br>Internal and External Suppression<br>(Mode 4 Replies)             |                               |                                                                                                             | OPERATIONS: Mode 4 Replies                       |                                          |
| 1                                                                                                          | A2TP3                         | 8v<br><br>0v             | No signal.<br>Go to step 2.                      |                                          |
| 2                                                                                                          | Collector Q42                 | 6.4v<br><br>0v           | No signal.<br>Go to step 3.                      | Replace transistor Q43.                  |
| 3                                                                                                          | Junction CR35, CR36, and CR37 | 24v<br>7.0v<br>-0.4v<br> | No signal.<br>Go to step 4.                      | Replace transistor Q42 or resistor R130. |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

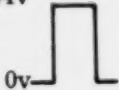
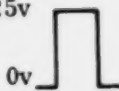
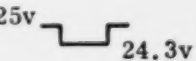
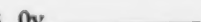
| CIRCUIT CARD: Decoder (A2)- Continued                                                          |               |                                                                                                   |                                                                          |                         |
|------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------|
| STEP                                                                                           | MEASURE       | SIGNAL                                                                                            | ABNORMAL INDICATION                                                      | NORMAL INDICATION       |
| FUNCTION/SYMPTOM:<br>No Generation of<br>Internal and External Suppression<br>(Mode 4 Replies) |               | OPERATIONS: Mode 4 Replies                                                                        |                                                                          |                         |
| 4                                                                                              | A2TP1         | 24v<br>          | No signal.<br>Go to step 5.                                              | Replace diode CR36.     |
| 5                                                                                              | Collector Q40 | 25v<br>          | No signal.<br>Go to step 6.                                              | Replace transistor Q41. |
| 6                                                                                              | Base Q40      | 25v<br> 24.3v   | No signal.<br>Go to step 7.                                              | Replace transistor Q40. |
| 7                                                                                              | Emitter Q38   | 12v<br>        | No signal.<br>Replace transistor Q38.                                    | Replace transistor Q39. |
| FUNCTION/SYMPTOM:<br>No AOC Bias<br>Output From Reply Rate Integrator                          |               | OPERATIONS: Mode 2, Code 0000,<br>STBY, PRF 3000 pps<br>MTL-84 dhv                                |                                                                          |                         |
| 1                                                                                              | A2TP2         | 8v<br>         | No signal.<br>Go to step 2.                                              |                         |
| 2                                                                                              | Base Q18      | 8.0v<br><br>0v | Ground.<br>Replace diode CR12<br>or resistors R57,<br>R58, as applicable | Go to step 3.           |

Table 3-10 Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

| CIRCUIT CARD: Decoder (A2) - Continued           |               |                                                                                                   |                                                                                                                |                                                                        |
|--------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| STEP                                             | MEASURE       | SIGNAL                                                                                            | ABNORMAL INDICATION                                                                                            | NORMAL INDICATION                                                      |
| FUNCTION/SYMPTOM:                                |               | OPERATIONS:                                                                                       |                                                                                                                |                                                                        |
| No AOC Bias<br>Output From Reply Rate Integrator |               | Mode 2, Code 0C00,<br>STBY, PRF 3000 pps<br>MTL-84 dbv                                            |                                                                                                                |                                                                        |
| 3                                                | Base Q17      | Dc voltage more negative than base of Q18.                                                        | 9.5 vdc.<br>Go to step 4.                                                                                      | Replace transistor Q17 or Q18, as applicable.                          |
| 4                                                | Collector Q28 | Dc voltage more negative than base of Q18.                                                        | 9.5 vdc.<br>Go to step 5.                                                                                      | Replace diode CR11.                                                    |
| 5                                                | Base Q29      | Adjustable dc 1 to 8 VDC                                                                          | Ground.<br>R89 not effective.<br>Replace diode CR44, resistors R38, R89, R90 or transistor Q29, as applicable. | Go to step 6.                                                          |
| 6                                                | Base Q28      | Dc voltage more positive than base Q29.                                                           | No signal.<br>Go to step 7.                                                                                    | Replace transistors Q28 or Q29, as applicable.                         |
| 7                                                | Collector Q27 | 12v<br>3v      | No signal.<br>Go to step 8.                                                                                    | Replace transistor Q49, capacitor C28, or resistor R83, as applicable. |
| 8                                                | Collector Q47 | 17.7v<br>0.2v  | No signal.<br>Go to step 9.                                                                                    | Replace transistor Q27.                                                |
| 9                                                | Collector Q26 | 8v<br>0.2v     | No signal.<br>Go to step 10.                                                                                   | Replace transistor Q47.                                                |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

| CIRCUIT CARD: Decoder (A2) - Continued                                |               |                                                                                     |                                                                                                                              |                                                    |
|-----------------------------------------------------------------------|---------------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| STEP                                                                  | MEASURE       | SIGNAL                                                                              | ABNORMAL INDICATION                                                                                                          | NORMAL INDICATION                                  |
| FUNCTION/SYMPTOM:<br>No AOC Bias<br>Output From Reply Rate Integrator |               | OPERATIONS: Mode 2, Code 0000,<br>STBY, PRF 3000 pps,<br>MTL-84 dbv                 |                                                                                                                              |                                                    |
| 10                                                                    | Collector Q25 |    | No signal.<br><br>Replace transistor Q25.                                                                                    | Replace transistor Q26.                            |
| FUNCTION/SYMPTOM:<br>No AOC Bias Output<br>From Duty Cycle Integrator |               | OPERATIONS: Mode 2, Code 7777,<br>NORM PRF 1800 pps,<br>MTL-84 dbv                  |                                                                                                                              |                                                    |
| 1                                                                     | A2TP2         |    | No signal.<br><br>Go to step 2.                                                                                              |                                                    |
| 2                                                                     | Base Q18      |  | Ground.<br><br>Replace diode CR12<br>or resistors R57,<br>R58, as applicable.                                                | Go to step 3.                                      |
| 3                                                                     | Base Q17      | Dc voltage<br>more negative<br>than base of<br>Q18.                                 | No signal.<br><br>Go to step 4.                                                                                              | Replace transistor<br>Q17 or Q18 as<br>applicable. |
| 4                                                                     | Collector Q15 | Dc voltage<br>more negative<br>than base of<br>Q18.                                 | No signal.<br><br>Go to step 5.                                                                                              | Replace diode CR9.                                 |
| 5                                                                     | Base Q16      | Adjustable<br>dc 1 to<br>8 VDC.                                                     | Ground.<br><br>R89 not effective.<br>Replace diode CR10,<br>resistors R50, R51,<br>R52, or transistor<br>Q16, as applicable. | Go to step 6.                                      |



Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

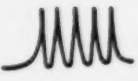
| CIRCUIT CARD: Decoder (A2) - Continued                               |                    |                                                                                                    |                                                                                      |                                                     |
|----------------------------------------------------------------------|--------------------|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------|
| STEP                                                                 | MEASURE            | SIGNAL                                                                                             | ABNORMAL INDICATION                                                                  | NORMAL INDICATION                                   |
| FUNCTION/SYMPOM:<br>No AOC Bias Output<br>From Duty Cycle Integrator |                    | OPERATIONS: Mode 2, Code 7777,<br>NORM PRF 1300 pps,<br>MTL-84 dbv                                 |                                                                                      |                                                     |
| 6                                                                    | Base<br>Q15        | Dc voltage<br>more positive<br>than base of<br>Q16                                                 | No signal.<br>Go to step 7.                                                          | Replace transistor<br>Q15.                          |
| 7                                                                    | A2TP6              | 12.6v<br><br>0.6v | No signal.<br>Replace transistor<br>Q13 or associated<br>component as<br>applicable. | Replace transistor<br>Q14.                          |
| FUNCTION/SYMPOM:<br>No AOC Bias Output<br>From SLS Rate Integrator   |                    | OPERATIONS: Mode 2, Code 0000,<br>STBY *PRF 8000 pps,<br>MTL-87 dbv , ISLS<br>input                |                                                                                      |                                                     |
| 1                                                                    | A2TP2              | 8v<br>0v        | No signal.<br>Go to step 2.                                                          |                                                     |
| 2                                                                    | Base<br>Q18        | 8.0v <br>0v     | Ground.<br>Replace diode CR12<br>or resistor R57 as<br>applicable.                   | Go to step 3.                                       |
| 3                                                                    | Base<br>Q17        | Dc voltage<br>more negative<br>than base<br>Q18.                                                   | 9.7 vdc.<br>Go to step 4.                                                            | Replace transistors<br>Q17 or Q18 as<br>applicable. |
| 4                                                                    | Collec-<br>tor Q11 | Dc voltage<br>more negative<br>than base<br>Q18.                                                   | 9.7 vdc.<br>Go to step 5.                                                            | Replace diode CR6.                                  |



Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

| CIRCUIT CARD: Decoder (A2) - Continued                             |                    |                                                                                                   |                                                                               |                                                                                 |
|--------------------------------------------------------------------|--------------------|---------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| STEP                                                               | MEASURE            | SIGNAL                                                                                            | ABNORMAL INDICATION                                                           | NORMAL INDICATION                                                               |
| FUNCTION/SYMPOM:<br>No AOC Bias Output<br>From SLS Rate Integrator |                    | OPERATIONS: Mode 2, Code 0000,<br>STBY *PRF 8000 pps,<br>MTL-87 dbv, ISLS<br>Input                |                                                                               |                                                                                 |
| 5                                                                  | Base<br>Q12        | 4v <br><br>0v    | Ground.<br><br>Replace diode CR3,<br>resistors R39, R40<br>as applicable.     | Go to step 6.                                                                   |
| 6                                                                  | Emitter<br>Q48     | Dc voltage<br>more positive<br>than base<br>Q12.                                                  | No signal.<br><br>Go to step 7.                                               | Replace transistors<br>Q11 or Q12, as<br>applicable.                            |
| 7                                                                  | Collec-<br>tor Q10 | 12v <br>4.8v     | No signal.<br><br>Go to step 8.                                               | Replace transistor<br>Q43, capacitor C15,<br>or resistor R35, as<br>applicable. |
| 8                                                                  | Collec-<br>tor Q46 | 17.7v <br>0.2v | No signal.<br><br>Go to step 9.                                               | Replace transistor<br>Q10.                                                      |
| 9                                                                  | A2TP5              | 9.5v <br>0v    | No signal.<br><br>Follow procedures<br>for NO SUPPRESSION<br>WITH ISLS INPUT. | Replace transistor<br>Q46.                                                      |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

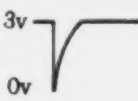
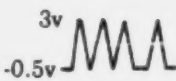
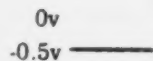
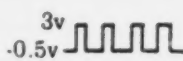
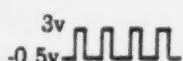
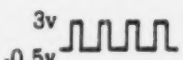
| CIRCUIT CARD: Mode 4 (A3) (RT-859A/APX-72)                  |         |                                                                                     |                                                                                   |                               |
|-------------------------------------------------------------|---------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------|
| STEP                                                        | MEASURE | SIGNAL                                                                              | ABNORMAL INDICATION                                                               | NORMAL INDICATION             |
| FUNCTION/SYMPOM: Incorrect Decode Strobe OPERATIONS: Mode 4 |         |                                                                                     |                                                                                   |                               |
| 1                                                           | A3TP7   |    | 3.5 vdc, no pulse.<br>Go to step 2.                                               | Go to next sequence of tests. |
| 2                                                           | A201-5  |    | No pulse, or insufficient amplitude.<br>Check R201, R202, and C201. Go to step 3. | Go to step 4.                 |
| 3                                                           | A202-12 |    | +2v or higher.<br>Check A204-8 (+6v) VR201, R240.                                 | Check A202 and A201.          |
| 4                                                           | A201-4  |  | No pulse or insufficient amplitude.<br>Check R203, R204, R205, and Q201.          | Go to step 5.                 |
| 5                                                           | A201-1  |  | No pulse or insufficient amplitude.<br>Check R206, R207, R208, and Q202.          | Go to step 6.                 |
| 6                                                           | A201-2  |  | No pulse or insufficient amplitude.<br>Check R209, R210, R211, and Q203.          | Replace A201.                 |

Table 3-10. Functional Troubleshooting Chart.  
Extender Board Procedure - Continued

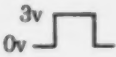
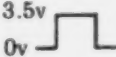
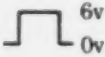
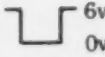
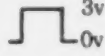
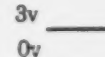
| CIRCUIT CARD: Mode 4 (A3) (RT-859A/APX-72) - Continued |              |                                                                                     |                                          |                                             |
|--------------------------------------------------------|--------------|-------------------------------------------------------------------------------------|------------------------------------------|---------------------------------------------|
| STEP                                                   | MEASURE      | SIGNAL                                                                              | ABNORMAL INDICATION                      | NORMAL INDICATION                           |
| FUNCTION/SYMPOM: No Enable Trigger                     |              |                                                                                     | OPERATIONS: Mode 4                       |                                             |
| 1                                                      | Pin 20       |    | No signal.<br>Go to step 2.              | Go to next sequence of tests.               |
| 2                                                      | Collector Q9 |    | No signal.<br>Go to step 3.              | Check Q10 and associated circuit.           |
| 3                                                      | Collector Q8 |    | No signal.<br>Go to step 4.              | Check Q9, C9, and associated circuit.       |
| 4                                                      | A202-3       |   | No signal.<br>Go to step 5.              | Check CR16, C7, Q8, and associated circuit. |
| 5                                                      | A202-1       |  | No signal.<br>Check A203-8.              | Go to step 6.                               |
| 6                                                      | A202-2       |  | Improper level (0 vdc).<br>Go to step 7. | Check A202.                                 |
| 7                                                      | A6-1         |  | No signal.<br>Check track.               | Check A6 and associated circuit.            |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

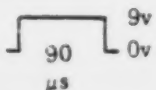
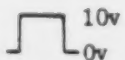
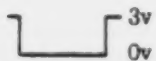
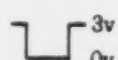
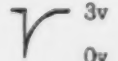
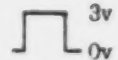
| CIRCUIT CARD: Mode 4 (A3) (RT-859A/APX-72) - Continued             |                |                                                                                     |                                                                |                                    |
|--------------------------------------------------------------------|----------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------|------------------------------------|
| STEP                                                               | MEASURE        | SIGNAL                                                                              | ABNORMAL INDICATION                                            | NORMAL INDICATION                  |
| FUNCTION/SYMPTOM: Incorrect SIF Suppression OPERATIONS: Mode 4     |                |                                                                                     |                                                                |                                    |
| 1                                                                  | Pin J          |    | If improper width, adjust R215.<br>No signal.<br>Go to step 2. | Go to next sequence of tests.      |
| 2                                                                  | Collector Q205 |    | No signal.<br>Go to step 3.                                    | Check Q206 and associated circuit. |
| 3                                                                  | A203-6         |   | No signal.<br>Check A203.                                      | Check Q205 and associated circuit. |
| FUNCTION/SYMPTOM: Incorrect Three Pulse Decoder OPERATIONS: Mode 4 |                |                                                                                     |                                                                |                                    |
| 1                                                                  | A3TP6          |  | No signal.<br>Go to step 2.                                    | Go to next sequence of tests.      |
| 2                                                                  | A202-10        |  | No signal.<br>Go to step 3.                                    | Check A202 and associated circuit. |
| 3                                                                  | A201-8         |  | No signal.<br>Check A201.                                      | Go to step 4.<br>Check CR201.      |
| 4                                                                  | Collector Q213 |  | No signal.<br>Check C202.                                      | Check Q211.                        |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

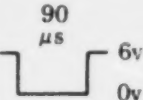
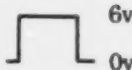
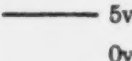
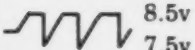
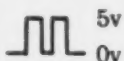
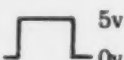
| CIRCUIT CARD: Mode 4 (A3) (RT-859A/APX-72) - Continued  |              |                                                                                     |                                                                                           |                                           |
|---------------------------------------------------------|--------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------|
| STEP                                                    | MEASURE      | SIGNAL                                                                              | ABNORMAL INDICATION                                                                       | NORMAL INDICATION                         |
| FUNCTION/SYMPTOM: No AOC Output OPERATIONS: Mode 4      |              |                                                                                     |                                                                                           |                                           |
| 1                                                       | A202-3       |    | Go to step 5, page 4-145.<br><br>If improper width, adjust R215.                          | Go to step 2.                             |
| 2                                                       | Collector Q4 |    | Ground.<br><br>Check Q4 and associated circuit.                                           | Go to step 3.                             |
| 3                                                       | Emitter Q5   |   | Ground, or slightly positive.<br><br>Check C2, CR3, Q5 and associated circuit.            | Go to step 4.                             |
| 4                                                       | Collector Q6 |  | 12 vdc. Check Q6, Q7, CR5, and setting of R29.                                            | Check CR4.                                |
| FUNCTION/SYMPTOM: No Challenge Video OPERATIONS: Mode 4 |              |                                                                                     |                                                                                           |                                           |
| 1                                                       | A202-6       |  | Too many pulses (4).<br>Go to step 2.<br><br>No signal, or 1v amplitude.<br>Go to step 3. | Check Q209, CR203 and associated circuit. |
| 2                                                       | A202-8       |  | +5v.<br><br>Check A202-9 and 10.                                                          | Check CR207.                              |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

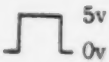
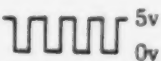
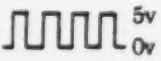
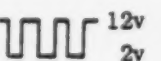
| CIRCUIT CARD: Mode 4 (A3) (RT-859A/APX-72) - Continued      |                |                                                                                     |                                                        |                                                |
|-------------------------------------------------------------|----------------|-------------------------------------------------------------------------------------|--------------------------------------------------------|------------------------------------------------|
| STEP                                                        | MEASURE        | SIGNAL                                                                              | ABNORMAL INDICATION                                    | NORMAL INDICATION                              |
| FUNCTION/SYMPOM: No Challenge Video      OPERATIONS: Mode 4 |                |                                                                                     |                                                        |                                                |
| 3                                                           | A202-8         |    | 0 vdc.<br>Check A202.                                  | Go to step 4.                                  |
| 4                                                           | Collector Q207 |    | No signal.<br>Go to step 5.                            | Check A202.                                    |
| 5                                                           | Emitter Q210   |    | No signal.<br>Go to step 6.                            | Check Q207, Q208, C207 and associated circuit. |
| 6                                                           | Base Q210      |  | No signal.<br>Check CR205, CR206, and A3DL1.           | Check Q210                                     |
| FUNCTION/SYMPOM: No Mode 4 Replies      OPERATIONS: Mode 4  |                |                                                                                     |                                                        |                                                |
| 1                                                           | Collector Q35  |  | 12 vdc.<br>Check Q35, CR1, A12 and associated circuit. | Check CR6.                                     |



Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

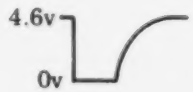
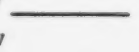
| CIRCUIT CARD: Mode 4 (A3) (RT-859A/APX-72) - Continued |               |                                                                                                               |                                               |                                                                                        |
|--------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------|-----------------------------------------------|----------------------------------------------------------------------------------------|
| STEP                                                   | MEASURE       | SIGNAL                                                                                                        | ABNORMAL INDICATION                           | NORMAL INDICATION                                                                      |
| FUNCTION/SYMPOM: No Audio Output                       |               | OPERATIONS: Mode 4, MASTER to STBY, PRF 1000 pps                                                              |                                               |                                                                                        |
| 1                                                      | A3TP1         | 3.5v<br>0v<br>-3v<br>-6v<br> | Collector Q22 at 5 or 3 vdc.<br>Go to step 2. | Check transformer T1 and associated components. Replace as required.                   |
| 2                                                      | Collector Q20 | 6.2v<br>0v<br>               | Ground.<br>Go to step 3.                      | Check transistors Q21, Q22, and associated components. Replace as required.            |
| 3                                                      | A8-1          | 4.8v<br>0v<br>              | Ground.<br>Go to step 4.                      | Check transistors Q19, Q20, diode CR8, and associated components. Replace as required. |
| 4                                                      | A3TP2         | 4.6v<br>0v<br>             | No signal.<br>Go to step 6.                   | Go to step 5.                                                                          |
| 5                                                      | A3TP4         | 4.8v<br>0v<br>             | Go to step 6.                                 | Replace A8. Check associated components and replace as required.                       |
| 6                                                      | A3TP8         | 4.8v<br>0v<br>             | Ground, no signal.<br>Go to step 13.          | Go to step 7.                                                                          |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

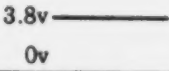
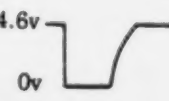
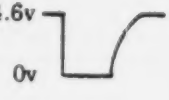
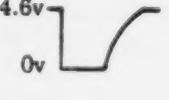
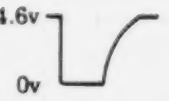
| CIRCUIT CARD: Mode 4 (A3) (RT-859A/APX-72) - Continued |                              |                                                                                                        |                                                    |                   |
|--------------------------------------------------------|------------------------------|--------------------------------------------------------------------------------------------------------|----------------------------------------------------|-------------------|
| STEP                                                   | MEASURE                      | SIGNAL                                                                                                 | ABNORMAL INDICATION                                | NORMAL INDICATION |
| FUNCTION/SYMPTOM: No Audio Output                      |                              | OPERATIONS: Mode 4, MASTER to STBY, PRF 1000 pps                                                       |                                                    |                   |
| 7                                                      | A7-11                        |  <p>3.8v<br/>0v</p>   | No signal.<br>Check A6 and inter-connecting track. | Go to step 8.     |
| 8                                                      | A7-10                        |  <p>3.8v<br/>0v</p>   | No signal.<br>Check A15.                           | Go to step 9.     |
| 9                                                      | A7-8<br>A7-8 disconnected    |  <p>4.6v<br/>0v</p>   | 4.6 vdc.<br>Replace A7.                            | Go to step 10.    |
| 10                                                     | A3TP2<br>A9-5,6 disconnected |  <p>4.6v<br/>0v</p> | 4.6 vdc.<br>Replace A9.                            | Go to step 11.    |
| 11                                                     | A3TP2<br>A10-3 disconnected  |  <p>4.6v<br/>0v</p> | 4.6 vdc.<br>Replace A10.                           | Go to step 12.    |
| 12                                                     | A3TP2<br>A8-3 disconnected   |  <p>4.6v<br/>0v</p> | 4.6 vdc.<br>Replace A8.                            | Go to step 16.    |

Table 3-10 Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

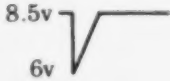
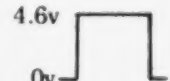
| CIRCUIT CARD: Mode 4 (A3) (RT-859A/APX-72) - Continued |                               |                                                                                     |                                                                                                                   |                                       |
|--------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| STEP                                                   | MEASURE                       | SIGNAL                                                                              | ABNORMAL INDICATION                                                                                               | NORMAL INDICATION                     |
| FUNCTION/SYMPTOM: No Audio Output                      |                               |                                                                                     | OPERATIONS:                                                                                                       | Mode 4, MASTER to STBY, PRF 1000 pps  |
| 13                                                     | A203-8                        |    | Ground.<br>Go to step 14.                                                                                         | Go to step 15.                        |
| 14                                                     | A203-1                        |    | Check C204, R222, R223 and associated components.                                                                 | Check A203 and associated components. |
| 15                                                     | A5-8<br><br>A5-8 disconnected |    | Ground.<br>Replace A5.<br>Check capacitor C206, resistors R99 and R110.<br>Replace as required.                   | N/A                                   |
| FUNCTION/SYMPTOM: No Audio Output                      |                               |                                                                                     | OPERATIONS:                                                                                                       | Mode 4 MASTER to NORM, PRF 1000 pps   |
| 16                                                     | A3TP4                         |  | No signal.<br>Go to step 18.                                                                                      | Go to step 17.                        |
| 17                                                     | A3TP2                         |  | N/A.                                                                                                              | Replace A8.                           |
| 18                                                     | A12-3                         |  | Examine track from terminal K.                                                                                    | Go to step 19.                        |
| 19                                                     | A12-4                         |  | Check A5 and associated components.<br>Replace as required.<br><br>Check for presence of modulation sample input. | Go to step 20.                        |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

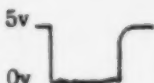
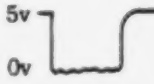
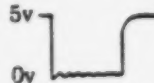
| CIRCUIT CARD: Mode 4 (A3) (RT-859A/APX-72) - Continued |                                                 |                                                                                     |                                                           |                   |
|--------------------------------------------------------|-------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------|-------------------|
| STEP                                                   | MEASURE                                         | SIGNAL                                                                              | ABNORMAL INDICATION                                       | NORMAL INDICATION |
| FUNCTION/SYMPTOM: No Audio Output                      |                                                 |                                                                                     | OPERATIONS: Mode 4, MASTER to NORM, PRF 1000 pps          |                   |
| 20                                                     | A12-6<br>A12-6 disconnected                     |    | Check A12 and associated components. Replace as required. | Go to step 21.    |
| 21                                                     | A3TP4<br>A13-5,6 disconnected                   |    | 5 vdc.<br>Replace A13.                                    | Go to step 22.    |
| 22                                                     | A3TP4<br>A16-3 disconnected                     |   | Replace A16.                                              | Go to step 23.    |
| 23                                                     | A3TP4<br>A8-4 disconnected                      |  | Replace A8.                                               |                   |
| FUNCTION/SYMPTOM: No Caution Light                     |                                                 |                                                                                     | OPERATIONS: Mode 4, MASTER to STBY, PRF 1000 pps          |                   |
| 1                                                      | A3TP3<br>Single pulse 4 interrogations in 33 MS |  | Go to step 2.                                             | Go to step 12.    |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

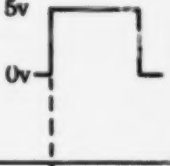
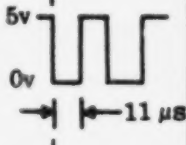
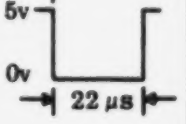
| CIRCUIT CARD: Mode 4 (A3) (RT-859A/APX-72) - Continued |                                                     |                                                                                     |                                                                                    |                   |
|--------------------------------------------------------|-----------------------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------|
| STEP                                                   | MEASURE                                             | SIGNAL                                                                              | ABNORMAL INDICATION                                                                | NORMAL INDICATION |
| FUNCTION/SYMPOM: No Caution Light                      |                                                     | OPERATIONS: Mode 4, MASTER to STBY, PRF 1000 pps                                    |                                                                                    |                   |
| 2                                                      | A10-6<br>Single pulse 4 interrogations in 33 MS     |    | Go to step 5.                                                                      | Go to step 3.     |
| 3                                                      | A9-10,11<br>Single pulse 4 interrogations in 33 MS  |   | Go to step 4.                                                                      | Go to step 4.     |
| 4                                                      | A11-10,11<br>Single pulse 4 interrogations in 33 MS |  | Go to step 7.                                                                      | Replace A7.       |
| 5                                                      | A3TP2                                               |  | N/A.<br>See previous procedures.                                                   | Go to step 6.     |
| 6                                                      | A10-6<br>A10-6 disconnected                         |  | No signal.<br>Replace A10.<br>Check associated components and replace as required. | Replace A7.       |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

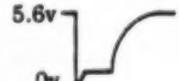
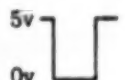
| CIRCUIT CARD: Mode 4 (A3) (RT-859A/APX-72) - Continued |                                     |                                                                                     |                                                     |                   |
|--------------------------------------------------------|-------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------|-------------------|
| STEP                                                   | MEASURE                             | SIGNAL                                                                              | ABNORMAL INDICATION                                 | NORMAL INDICATION |
| FUNCTION/SYMPOM: No Caution Light                      |                                     | OPERATIONS: Mode 4, MASTER to STBY, PRF 1000 pps                                    |                                                     |                   |
| 7                                                      | Collector Q32                       |    | No signal.<br>Go to step 3.                         | Go to step 10.    |
| 8                                                      | Collector Q32<br>All-1 disconnected |    | Ground.<br>Go to step 9.                            | Replace All.      |
| 9                                                      | Collector Q32<br>A9-1 disconnected  |   | Check Q32 and associated components.                | Replace A9.       |
| 10                                                     | All-10,11<br>All-10,11 disconnected |  | No signal.<br>Go to step 11.                        | Replace A7.       |
| 11                                                     | All-5,6                             |  | Replace A9.                                         | Replace All.      |
| 12                                                     | Collector Q11                       |  | Ground.<br>Check CR12, Q11, and associated circuit. | Go to step 13.    |



Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

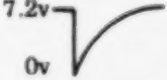
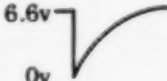
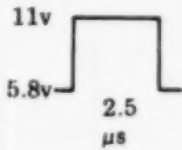
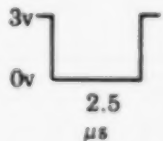
| CIRCUIT CARD: Mode 4 (A3) (RT-859A/APX-72)- Continued |                                                             |                                                                                     |                                                                                         |                   |
|-------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-------------------|
| STEP                                                  | MEASURE                                                     | SIGNAL                                                                              | ABNORMAL INDICATION                                                                     | NORMAL INDICATION |
| FUNCTION/SYMPOM: No Caution Light                     |                                                             | OPERATIONS: Mode 4, MASTER to STBY, PRF 1000 pps                                    |                                                                                         |                   |
| 13                                                    | Collector Q12<br><br>Single pulse 4 interrogations in 33 MS |    | 7.2 vdc.<br><br>Check transistor Q12 and associated components.<br>Replace as required. | Go to step 14.    |
| 14                                                    | Emitter Q13<br><br>Single pulse 4 interrogations in 33 MS   |    | Replace transistor Q13.                                                                 | Go to step 15.    |
| 15                                                    | Collector Q14<br><br>Single pulse 4 interrogations in 33 MS |  | Replace transistor Q14.                                                                 | Go to step 16.    |
| 16                                                    | Collector Q15<br><br>Single pulse 4 interrogations in 33 MS |  | 2 vdc.<br><br>Replace transistor Q15.                                                   | Go to step 17.    |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

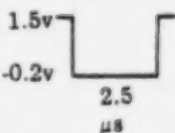
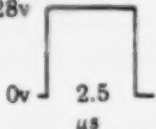
| CIRCUIT CARD: Mode 4 (A3) (RT-859A/APX-72)- Continued |                                                                            |                                                                                     |                                           |                         |
|-------------------------------------------------------|----------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------|-------------------------|
| STEP                                                  | MEASURE                                                                    | SIGNAL                                                                              | ABNORMAL INDICATION                       | NORMAL INDICATION       |
| FUNCTION/SYMPOM: No Caution<br>Light                  |                                                                            | OPERATIONS: Mode 4, MASTER to<br>STBY, PRF 1000 pps                                 |                                           |                         |
| 17                                                    | Emitter<br>Q23<br><br>Single<br>pulse 4<br>interro-<br>gations<br>in 33 MS |    | Replace transistor<br>Q23.                | Go to step 18.          |
| 18                                                    | Collec-<br>tor Q24                                                         |    | Ground.<br><br>Replace transistor<br>Q24. | Go to step 19.          |
| 19                                                    | Collec-<br>tor Q15<br><br>ZERO<br>M4                                       |  | 2 vdc.<br><br>Go to step 20.              |                         |
| 20                                                    | Cathode<br>diode CR9                                                       |  | 6 vdc.<br><br>Go to step 21.              | Replace diode CR9.      |
| 21                                                    | Terminal<br>B                                                              |  |                                           | Replace inductor<br>L1. |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

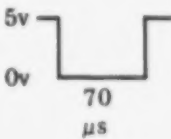
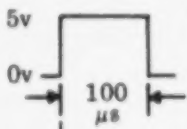
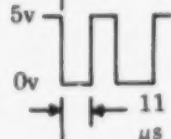
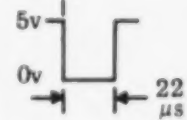
| CIRCUIT CARD: Mode 4 (A3) (RT-859A/APX-72)- Continued |                                                     |                                                                                     |                                  |                   |
|-------------------------------------------------------|-----------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------|-------------------|
| STEP                                                  | MEASURE                                             | SIGNAL                                                                              | ABNORMAL INDICATION              | NORMAL INDICATION |
| FUNCTION/SYMPOM: No Reply Light                       |                                                     | OPERATIONS: Mode 4, MASTER to NORM, PRF 1000 pps                                    |                                  |                   |
| 1                                                     | A3TP5<br>Single pulse 4 interrogations in 33 MS     |    | Go to step 2.                    | Go to step 12.    |
| 2                                                     | A16-6<br>Single pulse 4 interrogations in 33 MS     |    | Go to step 5.                    | Go to step 3.     |
| 3                                                     | A13-10,11<br>Single pulse 4 interrogations in 33 MS |  | Go to step 5.                    | Go to step 4.     |
| 4                                                     | A14-10,11<br>Single pulse 4 interrogations in 33 MS |  | Go to step 7.                    | Replace A7.       |
| 5                                                     | A3TP4<br>Single pulse 4 interrogations in 33 MS     |  | N/A.<br>See previous procedures. | Go to step 6.     |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

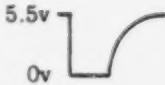
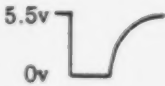
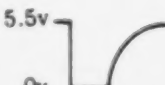
| CIRCUIT CARD: Mode 4 (A3) (RT-859A/APX-72)- Continued |                                         |                                                                                     |                                                                                        |                                      |
|-------------------------------------------------------|-----------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|--------------------------------------|
| STEP                                                  | MEASURE                                 | SIGNAL                                                                              | ABNORMAL INDICATION                                                                    | NORMAL INDICATION                    |
| FUNCTION/SYMPOM: No Reply Light                       |                                         |                                                                                     | OPERATIONS:                                                                            | Mode 4, MASTER to NORM, PRF 1000 pps |
| 6                                                     | A16-6<br><br>A16-6 disconnected         |    | No signal.<br><br>Replace A16.<br>Check associated components and replace as required. | Replace A7.                          |
| 7                                                     | Collector Q31                           |    | No signal.<br><br>Go to step 8.                                                        | Go to step 10.                       |
| 8                                                     | Collector Q31<br><br>A14-1 disconnected |   | No signal.<br><br>Go to step 9.                                                        | Replace A14.                         |
| 9                                                     | Collector Q31<br><br>A13-1 disconnected |  | Check Q31 and associated components.                                                   | Replace A13.                         |
| 10                                                    | A14-10,11<br><br>A14-10,11 disconnected |  | No signal.<br><br>Go to step 11.                                                       | Replace A7.                          |
| 11                                                    | A14-5,6                                 |  | Replace A13.                                                                           | Replace A14.                         |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

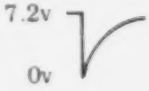
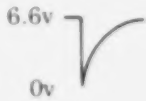
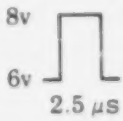
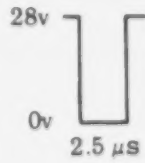
| CIRCUIT CARD: Mode 4 (A3) (RT-859A/APX-72) - Continued |                                                                                |                                                                                     |                                                                               |                   |
|--------------------------------------------------------|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-------------------|
| STEP                                                   | MEASURE                                                                        | SIGNAL                                                                              | ABNORMAL INDICATION                                                           | NORMAL INDICATION |
| FUNCTION/SYMPOM: No Reply<br>Light                     |                                                                                | OPERATIONS: Mode 4, MASTER to<br>NORM, PRF 1000 pps                                 |                                                                               |                   |
| 12                                                     | Collec-<br>tor Q25                                                             |    | Ground.<br><br>Check CR11, Q25,<br>and associated<br>circuit.                 | Go to step 13.    |
| 13                                                     | Collec-<br>tor Q26<br><br>Single<br>pulse 4<br>interro-<br>gations<br>in 33 MS |    | Check transistor<br>Q26 and associated<br>components.<br>Replace as required. | Go to step 14.    |
| 14                                                     | Emitter<br>Q27<br><br>Single<br>pulse 4<br>interro-<br>gations<br>in 33 MS     |  | Replace transistor<br>Q27.                                                    | Go to step 15.    |
| 15                                                     | Collec-<br>tor Q28<br><br>Single<br>pulse 4<br>interro-<br>gations<br>in 33 MS |  | Replace transistor<br>Q28.                                                    | Go to step 16.    |
| 16                                                     | Collec-<br>tor Q29<br><br>Single<br>pulse 4<br>interro-<br>gations<br>in 33 MS |  | 28 vdc.<br><br>Replace transistor<br>Q29.                                     | Go to step 17.    |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

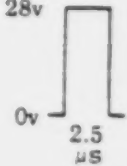
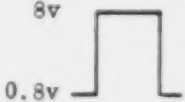
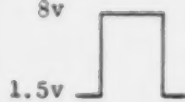
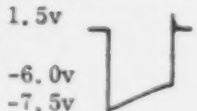
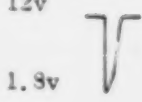
| CIRCUIT CARD: Mode 4 (A3) (RT-859A/APX-72)- Continued |                                                             |                                                                                     |                                        |                                                                     |
|-------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------|---------------------------------------------------------------------|
| STEP                                                  | MEASURE                                                     | SIGNAL                                                                              | ABNORMAL INDICATION                    | NORMAL INDICATION                                                   |
| FUNCTION/SYMPTOM: No Reply Light                      |                                                             | OPERATIONS: Mode 4, MASTER to NORM, PRF 1000 pps                                    |                                        |                                                                     |
| 17                                                    | Collector Q30<br><br>Single Pulse 4 interrogations in 33 MS |    | Ground.<br><br>Replace transistor Q30. |                                                                     |
| CIRCUIT CARD: Encoder Clock (A4)                      |                                                             |                                                                                     |                                        |                                                                     |
| FUNCTION/SYMPTOM: No Modulator Trigger Output         |                                                             | OPERATIONS: Mode 2, Code 7777, MASTER to NORM.                                      |                                        |                                                                     |
| 1                                                     | A4TP3                                                       |   | Ground.<br><br>Go to step 2.           | Go to step 6.                                                       |
| 2                                                     | Base Q5                                                     |  | Ground.<br><br>Go to step 3.           | Replace transistor Q5.                                              |
| 3                                                     | A4TP1                                                       |  | Ground.<br><br>Go to step 4.           | Check transistor Q4, diode CR77, resistor R10. Replace as required. |
| 4                                                     | Collector Q2                                                |  | 12 vdc.<br><br>Go to step 5.           | Check transistor Q3, capacitor C5, diode CR4. Replace as required.  |



Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

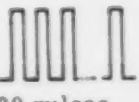
| CIRCUIT CARD: Encoder Clock (A4)- Continued  |               |                                                                                                                  |                                                                                                                                    |                                     |
|----------------------------------------------|---------------|------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| STEP                                         | MEASURE       | SIGNAL                                                                                                           | ABNORMAL INDICATION                                                                                                                | NORMAL INDICATION                   |
| FUNCTION/SYMPOM: No Modulator Trigger Output |               |                                                                                                                  | OPERATIONS: Mode 2, Code 7777, MASTER to NORM                                                                                      |                                     |
| 5                                            | Collector Q16 | 12v<br>0.6v<br>                 | 12 vdc.<br><br>Check transistor Q16 and associated components. Replace as required.                                                | Check diodes CR1, CR10 as required. |
| 6                                            | A4TP7         | 9v<br>8v<br>0v<br><br>29 pulses | Ground.<br><br>Go to step 7.                                                                                                       | Go to step 10.                      |
| 7                                            | Base Q7       | 0.6v<br>.11v<br><br>30 pulses  | Ground.<br><br>Check gated oscillator A4A1 or capacitor C7. Replace as required.                                                   | Go to step 8.                       |
| 8                                            | Collector Q7  | 12v<br>0.6v<br><br>30 pulses  | Ground.<br><br>Replace transistor Q7.                                                                                              | Go to step 9.                       |
| 9                                            | Base Q9       | 7.8v<br>0v<br>                | -0.5 vdc.<br><br>Replace transistors Q3, Q9, + dc voltage. Check transistor Q14, capacitor C11, resistor R31. Replace as required. | Go to step 10.                      |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

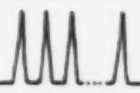
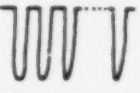
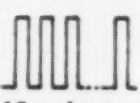
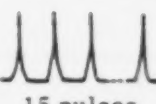
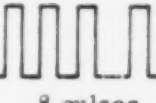
| CIRCUIT CARD: Encoder Clock (A4)- Continued  |               |                                                                                                                  |                                                                                       |                                                                     |
|----------------------------------------------|---------------|------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| STEP                                         | MEASURE       | SIGNAL                                                                                                           | ABNORMAL INDICATION                                                                   | NORMAL INDICATION                                                   |
| FUNCTION/SYMPOM: No Modulator Trigger Output |               |                                                                                                                  | OPERATIONS: Mode 2, Code 7777, MASTER to NORM                                         |                                                                     |
| 10                                           | A4TP6         | 12v<br>0.6v<br><br>15 pulses    | Ground.<br>Go to step 11.                                                             | Go to step 13.                                                      |
| 11                                           | Base Q11      | 0.6v<br>5.4v<br><br>15 pulses   | Ground.<br>Go to step 12.                                                             | Replace transistor Q11.                                             |
| 12                                           | Collector Q18 | 11.1v<br>0.6v<br><br>15 pulses  | Ground.<br>Isolate and check for a defective encoder counter.<br>Replace as required. | Replace transistors Q10, Q11, capacitor C9.<br>Replace as required. |
| 13                                           | Emitter Q19   | 11v<br>0v<br><br>15 pulses    | Ground.<br>Go to step 14.                                                             | Go to step 18.                                                      |
| 14                                           | Base Q19      | 7v<br>0.8v<br><br>15 pulses   | Ground.<br>Go to step 15                                                              | Replace transistor Q19.                                             |
| 15                                           | Collector Q25 | 11.1v<br>0.6v<br><br>8 pulses | Ground.<br>Check associated encoder counter and replace components as required.       | Go to step 16.                                                      |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

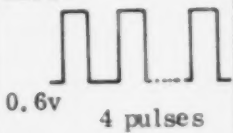
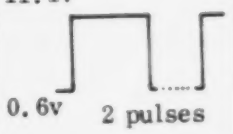
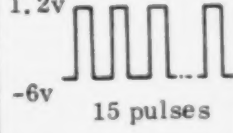
| CIRCUIT CARD: Encoder Clock (A4) - Continued  |               |                                                                                                                |                                                                                     |                                                                          |
|-----------------------------------------------|---------------|----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| STEP                                          | MEASURE       | SIGNAL                                                                                                         | ABNORMAL INDICATION                                                                 | NORMAL INDICATION                                                        |
| FUNCTION/SYMPOTM: No Modulator Trigger Output |               | OPERATIONS: Mode 2, Code 777, MASTER to NORM                                                                   |                                                                                     |                                                                          |
| 16                                            | Collector Q35 | 11.1v<br><br>0.6v<br>4 pulses | Ground.<br><br>Check associated encoder counter and replace components as required. | Go to step 17.<br><br>Go to step 17.                                     |
| 17                                            | Collector Q38 | 11.1v<br><br>0.6v<br>2 pulses | Ground.<br><br>Check associated encoder counter and replace components as required. | Check components associated with encoder matrix and replace as required. |
| 18                                            | Base Q20      | 1.2v<br><br>-6v<br>15 pulses | Ground.<br><br>Check transistor Q20, resistor R60. Replace as required.             | Go to step 19.                                                           |
| 19                                            | Base Q21      | 0v<br><br>-6v               | Ground.<br><br>Check transistor Q21, resistor R62. Replace as required.             | Go to step 20.                                                           |
| 20                                            | Collector Q22 | 0.6v<br><br>0v              | 12 vdc.<br><br>Go to step 21.                                                       | Check transistors Q20, Q21, diodes CR78, CR79. Replace as required.      |
| 21                                            | Collector Q40 | 12v<br><br>0v               | Ground.<br><br>Replace transistor Q40                                               | Replace transistor Q22.                                                  |

Table 3-30 Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

| CIRCUIT CARD: Encoder Clock (A4) - Continued    |               |                                                                                                |                                                                                                           |                                                                      |
|-------------------------------------------------|---------------|------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|
| STEP                                            | MEASURE       | SIGNAL                                                                                         | ABNORMAL INDICATION                                                                                       | NORMAL INDICATION                                                    |
| FUNCTION/SYMPOM: No Decoded Mode Storage Output |               |                                                                                                |                                                                                                           | OPERATIONS: Mode 2, Code 7777, MASTER to NORM                        |
| 1                                               | Terminal 4    | 11v _____<br>0v                                                                                | Ground.<br>Go to step 2.                                                                                  |                                                                      |
| 2                                               | Collector Q31 | 11.6v _____<br>0v                                                                              | Ground.<br>Go to step 3.                                                                                  | Check transistor Q27, resistors R88, R97, R101. Replace as required. |
| 3                                               | Base Q31      | 0v _____                                                                                       | Positive voltage.<br>Check transistors Q26, Q28, Q29, diode CR44, and capacitor C22. Replace as required. | Check transistor Q31, resistor R75. Replace as required.             |
| FUNCTION/SYMPOM: No Code Separation Pulse       |               |                                                                                                |                                                                                                           | OPERATIONS: Mode 2, Code 7777, MASTER to NORM                        |
| 1                                               | A4TP5         | 7.8v <br>0v | Ground.<br>Go to step 2.                                                                                  |                                                                      |
| 2                                               | Base Q14      | 0.7v _____<br>0v                                                                               | 6 vdc.<br>Go to step 3.                                                                                   | Replace transistor Q14.                                              |
| 3                                               | Collector Q12 | 6v _____<br>0v                                                                                 | Ground.                                                                                                   | Replace capacitor C11.                                               |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

| CIRCUIT CARD: Encoder Clock (A4) - Continued     |               |                 |                                                                                                          |                                                          |
|--------------------------------------------------|---------------|-----------------|----------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| STEP                                             | MEASURE       | SIGNAL          | ABNORMAL INDICATION                                                                                      | NORMAL INDICATION                                        |
| FUNCTION/SYMPOM: No Code Separation Pulse        |               |                 | OPERATIONS:                                                                                              | Mode 2, Code 7777, MASTER to NORM                        |
| 4                                                | Base Q12      | 0v<br>-6v ————— | Ground.<br><br>Check transistor Q12, diodes CR7, CR8, CR31, and resistors R27, R28. Replace as required. | Go to step 5.                                            |
| 5                                                | Base Q13      | 0v<br>-3v ————— | Ground.<br><br>Check transistor Q13 and resistors R32, R33. Replace as required.                         |                                                          |
| FUNCTION/SYMPOM: No X Pulse Other outputs Normal |               |                 | OPERATIONS:                                                                                              | Mode 2, Code 7777, MASTER to NORM<br>TERMINAL L GROUNDED |
| 1                                                | Collector Q39 | 12v —————<br>0v | Ground.<br><br>Go to step 2.                                                                             | Check diode CR24 and replace if required.                |
| 2                                                | Base Q39      | 0v<br>—————     | 6 vdc.<br><br>Replace diode CR74 or CR76.                                                                | Replace transistor Q39.                                  |

Table 3-10 Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

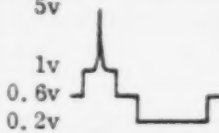
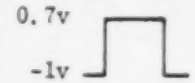
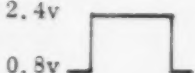
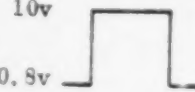
| CIRCUIT CARD: Encoder Control (A5) |                       |                                                                                                               |                                                                                 |                                                                                       |
|------------------------------------|-----------------------|---------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| STEP                               | MEASURE               | SIGNAL                                                                                                        | ABNORMAL INDICATION                                                             | NORMAL INDICATION                                                                     |
| FUNCTION/SYMPOM: No F1 Pulse       |                       |                                                                                                               | OPERATIONS: Mode 2, Code 0000, MASTER to NORM                                   |                                                                                       |
| 1                                  | A5TP7                 | 5v<br>1v<br>0.6v<br>0.2v<br> | 0.2 vdc.<br><br>Go to step 2.                                                   |                                                                                       |
| 2                                  | Base Q5               | 0.7v<br>-1v<br>              | 0.6 vdc.<br><br>Go to step 3.                                                   | Replace transistor Q5.                                                                |
| 3                                  | A5TP1                 | 0v<br>                       | 1 vdc.<br><br>Check diodes CR6, CR7, CR8, CR9. Replace as required.             | Go to step 4.                                                                         |
| 4                                  | Emitters Q2, A4Q1, Q4 | 0.8v<br>0.2v<br>           | Greater than 1 vdc.<br><br>Go to step 5.                                        |                                                                                       |
| 5                                  | Base Q2, A4Q1, Q4     | 2.4v<br>0.8v<br>           | 9V pulse.<br>Check diodes CR19, CR28, and replace as required.<br>Go to step 6. | Check transistors Q2, Q4, diodes CR4, CR36. Replace as required. Replace module A5A4. |
| 6                                  | Emitter A2Q1          | 9v<br>0.2v<br>             | 9 vdc.<br><br>Go to step 7.                                                     |                                                                                       |
| 7                                  | Base A2Q1             | 10v<br>0.8v<br>            |                                                                                 | Replace module A5A2.                                                                  |



Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

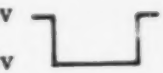
| CIRCUIT CARD: Encoder Control (A5)- Continued |                                      |                                                                                                                   |                                                                                        |                                                                                      |
|-----------------------------------------------|--------------------------------------|-------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| STEP                                          | MEASURE                              | SIGNAL                                                                                                            | ABNORMAL INDICATION                                                                    | NORMAL INDICATION                                                                    |
| FUNCTION/SYMPOM: No C1 Pulse                  |                                      | OPERATIONS: Mode 2, Code 0010,<br>MASTER to NORM                                                                  |                                                                                        |                                                                                      |
| 1                                             | A5TP2                                | 4.5v<br>1.4v<br>0.6v<br>0.2v<br> | 0.2 vdc.<br><br>Go to step 2.                                                          | Check pin 59 (ground).                                                               |
| 2                                             | Base Q6                              | 0.7v<br>-0.4v<br>-0.7v<br>       | 0.6 vdc.<br><br>Go to step 3.                                                          | Check associated circuit components and transistor Q6. Replace as required.          |
| 3                                             | Emitters<br>A3Q1,<br>A4Q1,<br>Q3, Q4 | 0.6v<br>0.2v<br>                 | Greater than 1 vdc<br>or 9V pulse.<br><br>Check diode CR30 and<br>replace if required. |                                                                                      |
| 4                                             | Base<br>A3Q1,<br>A4Q1,<br>Q3, Q4     | 2.4v<br>0.8v<br>               | +9V pulse.<br><br>Check diodes CR25,<br>CR28 and replace<br>if required.               | Check transistors<br>Q3, Q4. Replace<br>module A5A3 or<br>A5A4.<br><br>Go to step 5. |
| 5                                             | Emitter<br>A1Q1                      | 8v<br>0.8v<br>0.4v<br>         | 8.6 vdc.<br><br>Go to step 6.                                                          |                                                                                      |
| 6                                             | Base<br>A1Q1                         | 9v<br>1.5v<br>1.0v<br>         |                                                                                        | Replace module<br>A5A1.<br><br>Go to step 7.                                         |

Table 3-10 Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

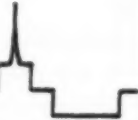
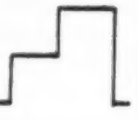
| CIRCUIT CARD: Encoder Control (A5) - Continued |                                                 |                                                                                                                    |                                                                                                       |                                                                                           |
|------------------------------------------------|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| STEP                                           | MEASURE                                         | SIGNAL                                                                                                             | ABNORMAL INDICATION                                                                                   | NORMAL INDICATION                                                                         |
| FUNCTION/SYMPOM: No C1 Pulse                   |                                                 |                                                                                                                    | OPERATIONS: Mode 2, Code 0010,<br>MASTER to NORM                                                      |                                                                                           |
| 7                                              | Emitter<br>A2Q1                                 | 9v<br><br>0.2v                    | 8.6 vdc.<br>Go to step 8.                                                                             |                                                                                           |
| 8                                              | Base<br>A2Q1                                    | 9.6v<br><br>0.8v                  |                                                                                                       | Replace module<br>A5A2.                                                                   |
| FUNCTION/SYMPOM: No A1 Pulse                   |                                                 |                                                                                                                    | OPERATIONS: Mode 2, Code 1000,<br>MASTER to NORM                                                      |                                                                                           |
| 1                                              | A5TP3                                           | 4.5v<br><br>1.4v<br>0.6v<br>0.2v | 0.2 vdc.<br>Go to step 2.                                                                             |                                                                                           |
| 2                                              | Base Q7                                         | 0.7v<br><br>-0.4v<br>-0.7v      | 0.6 vdc.<br>Go to step 3.                                                                             | Check transistor<br>Q7 and associated<br>circuit components.<br>Replace as re-<br>quired. |
| 3                                              | Emitters<br>A3Q1,<br>A4Q1, Q3,<br>Q4, Q1,<br>Q2 | 0.6v<br><br>0.2v                | 1 vdc or +9V pulse.<br>Check diodes CR31,<br>CR37, CR1, CR5.<br>Replace as required.<br>Go to step 4. |                                                                                           |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

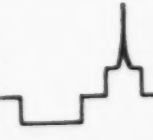
| CIRCUIT CARD: Encoder Control (A5) - Continued     |                                             |                                                                                                                     |                                                                                                          |                                                                         |
|----------------------------------------------------|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| STEP                                               | MEASURE                                     | SIGNAL                                                                                                              | ABNORMAL INDICATION                                                                                      | NORMAL INDICATION                                                       |
| FUNCTION/SYMPOM: No A1 Pulse                       |                                             |                                                                                                                     | OPERATIONS:                                                                                              | Mode 2, Code 1000,<br>MASTER to NORM                                    |
| 4                                                  | Base<br>A3Q1,<br>A4Q1,<br>Q3, Q4,<br>Q1, Q2 | 2.4v<br>0.8v<br>                   | +9V pulse.<br><br>Check diodes CR25,<br>CR28, CR10, CR19.<br>Replace as required.<br><br>Go to step 5.   | Check transistors<br>Q1, Q2, Q3, Q4.<br>Replace module<br>A5A3 or A5A4. |
| 5                                                  | Emitter<br>A1Q1                             | 8.0v<br>0.8v<br>0.4v<br>           | Ground.<br><br>Go to step 6.                                                                             |                                                                         |
| 6                                                  | Base<br>A1Q1                                | 9.0v<br>1.5v<br>1.0v<br>          |                                                                                                          | Replace module<br>A5A1.<br><br>Go to step 7.                            |
| 7                                                  | Emitter<br>A2Q1                             | 9.0v<br>0.2v<br>                 | Ground.<br><br>Go to step 8.                                                                             |                                                                         |
| 8                                                  | Base<br>A2Q1                                | 9.6v<br>0.8v<br>                 |                                                                                                          | Replace module<br>A5A2.                                                 |
| FUNCTION/SYMPOM: A2B4 Pulse<br>Instead of B4 Pulse |                                             |                                                                                                                     | OPERATIONS:                                                                                              | Mode 2, Code 0400,<br>MASTER to NORM                                    |
| 1                                                  | A5TP4                                       | 4.5v<br>1.4v<br>0.6v<br>0.2v<br> | <br><br>Go to step 2. |                                                                         |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

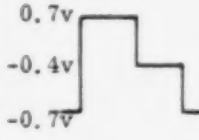
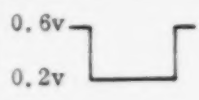
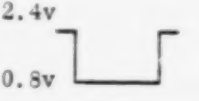
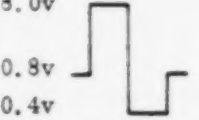
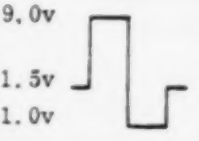
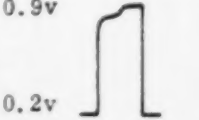
| CIRCUIT CARD: Encoder Control (A5) - Continued |                                                 |                                                                                     |                                                                                                         |                                                                                 |
|------------------------------------------------|-------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| STEP                                           | MEASURE                                         | SIGNAL                                                                              | ABNORMAL INDICATION                                                                                     | NORMAL INDICATION                                                               |
| FUNCTION/SYMPOM: A2B4 Pulse                    |                                                 | OPERATIONS: Mode 2, Code 0400,<br>MASTER to NORM                                    |                                                                                                         |                                                                                 |
| Instead of B4 Pulse                            |                                                 |                                                                                     |                                                                                                         |                                                                                 |
| 2                                              | Base Q9                                         |    | -1 vdc.<br>Go to step 5.                                                                                | Check associated circuit components.<br>Replace transistor Q9.<br>Go to step 3. |
| 3                                              | Emitters<br>A3Q1,<br>A4Q1,<br>Q3, Q4,<br>Q1, Q2 |    | 1 vdc or +9V pulse.<br>Check diodes CR33,<br>CR39, CR10, CR19.<br>Replace as required.<br>Go to step 4. |                                                                                 |
| 4                                              | Base<br>A3Q1,<br>A4Q1,<br>Q3, Q4,<br>Q1, Q2     |  | +9V pulse.<br>Check diodes CR25,<br>CR28, CR10, CR17.<br>Replace as required.<br>Go to step 5.          | Check transistors Q1, Q2, Q3, Q4.<br>Replace module A5A3, or A5A4.              |
| 5                                              | Emitter<br>A1Q1                                 |  | Ground.<br>Go to step 6.                                                                                |                                                                                 |
| 6                                              | Base<br>A1Q1                                    |  | Ground.<br>Go to step 7.                                                                                | Replace module A5A1.                                                            |
| 7                                              | Emitter<br>A2Q1                                 |  | Ground.<br>Go to step 8.                                                                                |                                                                                 |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

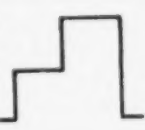
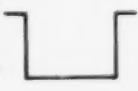
| CIRCUIT CARD: Encoder Control (A5) - Continued     |                                                 |                                                                                                                   |                                                                                                                            |                                                                                       |
|----------------------------------------------------|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| STEP                                               | MEASURE                                         | SIGNAL                                                                                                            | ABNORMAL INDICATION                                                                                                        | NORMAL INDICATION                                                                     |
| FUNCTION/SYMPOM: A2B4 Pulse<br>Instead of B4 Pulse |                                                 | OPERATIONS: Mode 2, Code 0400,<br>MASTER to NORM                                                                  |                                                                                                                            |                                                                                       |
| 8                                                  | Base<br>A2Q1                                    | 9.6v<br><br>0.8v                 |                                                                                                                            | Replace module<br>A5A2.                                                               |
| FUNCTION/SYMPOM: C2D2 Pulse<br>Instead of C2 Pulse |                                                 | OPERATIONS: Mode 2, Code 0020,<br>MASTER to NORM                                                                  |                                                                                                                            |                                                                                       |
| 1                                                  | A5TP8                                           | 4.5v<br>1.4v<br>0.6v<br>0.2v<br> | 4.5v<br>1.0v<br>0.6v<br><br>Go to step 2. |                                                                                       |
| 2                                                  | Base Q8                                         | 0.7v<br>-0.4v<br>-0.7v<br>     | 1 vdc<br>Go to step 5.                                                                                                     | Check associated<br>circuit components.<br>Replace transistor<br>Q8.<br>Go to step 3. |
| 3                                                  | Emitters<br>A3Q1,<br>A4Q1,<br>Q3, Q4,<br>Q1, Q2 | 0.6v<br>0.2v<br>               | 1 vdc or +9V pulse.<br>Check diodes CR32,<br>CR38. Replace as<br>required.<br>Go to step 4.                                |                                                                                       |
| 4                                                  | Base<br>A3Q1,<br>A4Q1,<br>Q3, Q4,<br>Q1, Q2     | 2.4v<br>0.8v<br>               | +9V pulse.<br>Check diodes CR25,<br>CR28. Replace as<br>required.<br>Go to step 5.                                         | Check transistors<br>Q1, Q2, Q3, Q4.<br>Replace module<br>A5A3 or A5A4.               |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

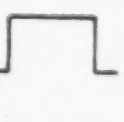
| CIRCUIT CARD: Encoder Control (A5) - Continued |                 |                                                                                                           |                                                                                                                       |                                                                       |
|------------------------------------------------|-----------------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| STEP                                           | MEASURE         | SIGNAL                                                                                                    | ABNORMAL INDICATION                                                                                                   | NORMAL INDICATION                                                     |
| FUNCTION/SYMP TOM: C2D2 Pulse                  |                 | OPERATIONS: Mode 2, Code U020,<br>Instead of C2 Pulse MASTER to NORM                                      |                                                                                                                       |                                                                       |
| 5                                              | Emitter<br>A1Q1 | 8.0v<br><br>0.8v<br>0.4v | Ground.<br>Go to step 6.                                                                                              | Go to step 6.                                                         |
| 6                                              | Base<br>A1Q1    | 9.0v<br><br>1.5v<br>1.0v |                                                                                                                       | Replace module<br>A5A1.<br>Go to step 7.                              |
| 7                                              | Emitter<br>A2Q1 | 9.0v<br><br>0.2v        | Ground.<br>Go to step 8.                                                                                              | Go to step 8.                                                         |
| 8                                              | Base<br>A2Q1    | 9.6v<br><br>0.8v       |                                                                                                                       | Replace module<br>A5A2.                                               |
| FUNCTION/SYMP TOM: C4D4 Pulse                  |                 | OPERATIONS: Mode 2, Code 0000,<br>Appears When Not Enabled MASTER to NORM                                 |                                                                                                                       |                                                                       |
| 1                                              | A5TP5           | 0.6v<br><br>0.2v       | <br>Go to step 2.                 |                                                                       |
| 2                                              | Base Q10        | 0.7v<br><br>-0.7v      | -0.4<br><br>-0.7<br>Go to step 3. | Check associated<br>circuit components.<br>Replace transistor<br>Q10. |



Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

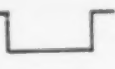
| CIRCUIT CARD: Encoder Control (A5) - Continued          |                                     |                                                                                                             |                                                                                                 |                                                                 |
|---------------------------------------------------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| STEP                                                    | MEASURE                             | SIGNAL                                                                                                      | ABNORMAL INDICATION                                                                             | NORMAL INDICATION                                               |
| FUNCTION/SYMPOM: C4D4 Pulse<br>Appears When Not Enabled |                                     |                                                                                                             | OPERATIONS: Mode 2, Code 0000,<br>MASTER to NORM                                                |                                                                 |
| 3                                                       | Emitter<br>A3Q1,<br>A4Q1,<br>Q3, Q4 | 0.6v<br>0.2v<br>           | 1 vdc or +9V pulse.<br>Check diodes CR34,<br>CR40. Replace as<br>required.<br><br>Go to step 4. |                                                                 |
| 4                                                       | Base<br>A3Q1,<br>A4Q1,<br>Q3, Q4    | 2.4v<br>0.8v<br>           | +9V pulse.<br>Check diodes CR25,<br>CR28. Replace as<br>required.<br><br>Go to step 5.          | Check transistors<br>Q3, Q4. Replace<br>module A5A3 or<br>A5A4. |
| 5                                                       | Emitter<br>A1Q1                     | 8.0v<br>0.8v<br>0.4v<br> | Ground.<br><br>Go to step 6.                                                                    |                                                                 |
| 6                                                       | Base<br>A1Q1                        | 9.0v<br>1.5v<br>1.0v<br> |                                                                                                 | Replace module<br>A5A1.<br><br>Go to step 7.                    |
| 7                                                       | Emitter<br>A2Q1                     | 9.0v<br>0.2v<br>         | Ground.<br><br>Go to step 8.                                                                    |                                                                 |
| 8                                                       | Base<br>A2Q1                        | 9.6v<br>0.8v<br>         |                                                                                                 | Replace module<br>A5A2.                                         |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

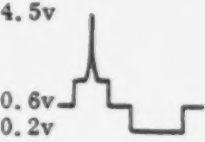
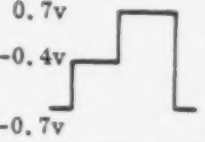
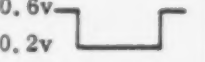
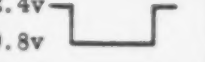
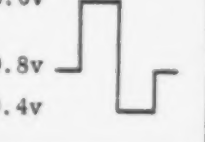
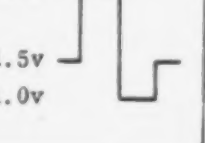
| CIRCUIT CARD: Encoder Control (A5) - Continued                                   |                                       |                                                                                                             |                                                                                       |                                                              |
|----------------------------------------------------------------------------------|---------------------------------------|-------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--------------------------------------------------------------|
| STEP                                                                             | MEASURE                               | SIGNAL                                                                                                      | ABNORMAL INDICATION                                                                   | NORMAL INDICATION                                            |
| FUNCTION/SYMPTOM: No C4 Pulse      OPERATIONS: Mode 2, Code 0040, MASTER to NORM |                                       |                                                                                                             |                                                                                       |                                                              |
| 1                                                                                | A5TP5                                 | 4.5v<br><br>0.6v<br>0.2v   | 0.2 vdc.<br>Go to step 2.                                                             |                                                              |
| 2                                                                                | Base Q10                              | 0.7v<br><br>-0.4v<br>-0.7v | 0.6 vdc.<br>Go to step 3.                                                             | Check associated circuit components. Replace transistor Q10. |
| 3                                                                                | Emitters<br>A3Q4,<br>A4Q1,<br>Q3, Q4, | 0.6v<br><br>0.2v          | 1 vdc or +9V pulse.<br>Check diodes CR34, CR40. Replace as required.<br>Go to step 4. |                                                              |
| 4                                                                                | Base<br>A3Q1,<br>A4Q1,<br>Q3, Q4      | 2.4v<br><br>0.8v         | +9V pulse.<br>Check diodes CR25, CR28. Replace as required.<br>Go to step 5.          | Check transistors Q3, Q4. Replace module A5A3 or A5A4.       |
| 5                                                                                | Emitter<br>A1Q1                       | 8.0v<br><br>0.8v<br>0.4v | 8.6 vdc.<br>Go to step 6.                                                             |                                                              |
| 6                                                                                | Base<br>A1Q1                          | 9.0v<br><br>1.5v<br>1.0v |                                                                                       | Replace module A5A1.<br>Go to step 7.                        |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

CIRCUIT CARD: Encoder Control (A5) - Continued

| STEP                          | MEASURE                        | SIGNAL                                                                                                              | ABNORMAL INDICATION                                                   | NORMAL INDICATION                                                       |
|-------------------------------|--------------------------------|---------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|-------------------------------------------------------------------------|
| FUNCTION/SYMPTOM: No C4 Pulse |                                | OPERATIONS: Mode 2, Code 0040,<br>MASTER to NORM                                                                    |                                                                       |                                                                         |
| 7                             | Emitter<br>A2Q1                | 9.0v<br><br>0.2v                   | 8.6 vdc.<br>Go to step 8.                                             |                                                                         |
| 8                             | Base<br>A2Q1                   | 9.6v<br><br>0.8v                   |                                                                       | Replace module<br>A5A2.                                                 |
| FUNCTION/SYMPTOM: No F2 Pulse |                                | OPERATIONS: Mode 2, Code 0000,<br>MASTER to NORM                                                                    |                                                                       |                                                                         |
| 1                             | A5TP10                         | 4.5v<br><br>1.4v<br>0.6v<br>0.2v | 0.2 vdc.<br>Go to step 2.                                             |                                                                         |
| 2                             | Base Q11                       | 0.6v<br><br>-0.7v                | 0.6 vdc.<br>Go to step 3.                                             | Check associated<br>circuit compo-<br>nents. Replace<br>transistor Q11. |
| 3                             | A5TP1                          | 0v<br>                           | 1 vdc.<br>Check diodes CR6,<br>CR7, CR8, CR9.<br>Replace as required. | Go to step 4.                                                           |
| 4                             | Emitters<br>Q1,<br>A3Q1,<br>Q3 | 0.8v<br><br>0.2v                 | 1 vdc.<br>Go to step 5.                                               |                                                                         |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

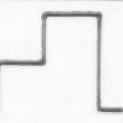
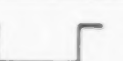
| CIRCUIT CARD: Encoder Control (A5) - Continued                                    |                                             |                                                                                                                     |                                                                                           |                                                                                |
|-----------------------------------------------------------------------------------|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| STEP                                                                              | MEASURE                                     | SIGNAL                                                                                                              | ABNORMAL INDICATION                                                                       | NORMAL INDICATION                                                              |
| FUNCTION/SYMP TOM: No F2 Pulse      OPERATIONS: Mode 2, Code 0000, MASTER to NORM |                                             |                                                                                                                     |                                                                                           |                                                                                |
| 5                                                                                 | Base Q1<br>A3Q1,<br>Q3                      | 2.4v<br><br>0.8v                   | 9V pulse.<br><br>Check diodes CR19,<br>CR28. Replace as<br>required.<br><br>Go to step 6. | Check transistors<br>Q1, Q3, diode CR3,<br>CR35. Replace<br>module A5A4.       |
| 6                                                                                 | Emitter<br>A1Q1                             | 8.6v<br><br>0.8v<br>0.4v          | 9 vdc.<br><br>Go to step 7.                                                               |                                                                                |
| 7                                                                                 | Base<br>A1Q1                                | 9.0v<br><br>1.5v<br>1.0v         |                                                                                           | Replace module A5A2.                                                           |
| FUNCTION/SYMP TOM: No C1 Pulse      OPERATIONS: Mode C, C1 Pulse MASTER to NORM   |                                             |                                                                                                                     |                                                                                           |                                                                                |
| 1                                                                                 | A5TP2                                       | 4.5v<br><br>1.0v<br>0.6v<br>0.2v | 0.2 vdc.<br><br>Go to step 2.                                                             |                                                                                |
| 2                                                                                 | Base Q6                                     | 0.7v<br><br>-0.4v<br>-0.7v       | 0.6 vdc.<br><br>Go to step 3.                                                             | Check transistor Q6<br>and associated com-<br>ponents. Replace<br>as required. |
| 3                                                                                 | Emitters<br>A1Q1,<br>A2Q1,<br>A3Q1,<br>A4Q1 | 0.6v<br><br>0.2v                 | 1 vdc or +9V pulse.<br><br>Go to step 4.                                                  |                                                                                |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

| CIRCUIT CARD: Encoder Control (A5) - Continued |                                         |                                                                                                         |                                                                                          |                   |
|------------------------------------------------|-----------------------------------------|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-------------------|
| STEP                                           | MEASURE                                 | SIGNAL                                                                                                  | ABNORMAL INDICATION                                                                      | NORMAL INDICATION |
| FUNCTION/SYMPTOM: No C1 Pulse                  |                                         | OPERATIONS: Mode C, C1 Pulse<br>MASTER to NORM                                                          |                                                                                          |                   |
| 4                                              | Base<br>A1Q1,<br>A2Q1,<br>A3Q1,<br>A4Q1 | 2.4v<br>0.8v           | +9V pulse.<br><br>Replace module<br>A5A1, A5A2, A5A3,<br>or A5A4                         | Go to step 5.     |
| 5                                              | Emitter<br>Q3                           | 8.0v<br>0.8v<br>0.4v   | 8.6 vdc.<br><br>Check diodes CR31,<br>CR35. Replace as<br>required.<br><br>Go to step 6. |                   |
| 6                                              | Base Q3                                 | 9.0v<br>1.5v<br>1.0v  | 8.6 vdc.<br><br>Check diode CR25.<br>Replace transistor<br>Q3.                           | Go to step 7.     |
| 7                                              | Emitter<br>Q4                           | 9.0v<br>0.2v         | 8.6 vdc.<br><br>Check diodes CR6,<br>CR40. Replace as<br>required.<br><br>Go to step 8.  |                   |
| 8                                              | Base Q4                                 | 9.6v<br>0.8v         | 8.6 vdc.<br><br>Check diode CR28.<br>Replace transistor<br>Q4.                           |                   |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

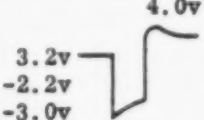
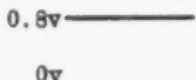
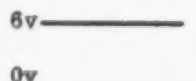
| CIRCUIT CARD: Encoder Gating (A6) - Continued |               |                                                                                     |                                                                                 |                                          |
|-----------------------------------------------|---------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|------------------------------------------|
| STEP                                          | MEASURE       | SIGNAL                                                                              | ABNORMAL INDICATION                                                             | NORMAL INDICATION                        |
| FUNCTION/SYMPOM: No D4 Pulse<br>In Mode C     |               |                                                                                     | OPERATIONS: Mode C, Full Code,<br>MASTER to STBY                                |                                          |
| 1                                             | A6TP5         |    | 3.2 vdc.<br>Go to step 2.                                                       |                                          |
| 2                                             | Collector Q11 |    | 12 vdc.<br>Go to step 3.                                                        | Go to step 6.                            |
| 3                                             | Collector Q12 |    | 20 vdc.<br>Go to step 4.                                                        |                                          |
| 4                                             | Base Q12      |  | -0.5 vdc.<br>Go to step 5.                                                      | Replace transistor Q12.<br>Go to step 6. |
| 5                                             | Collector Q13 |  | Ground.<br>Check transistor Q13 and associated components. Replace as required. |                                          |
| 6                                             | Base Q11      |  | Ground.<br>Check resistors R53 and R55. Replace as required.                    | Replace transistor Q11.                  |



Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

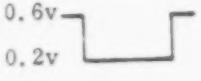
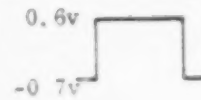
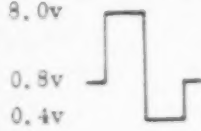
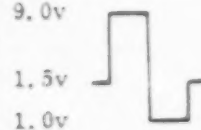
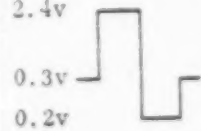
| CIRCUIT CARD: Encoder Control (A5) - Continued |                  |                                                                                                             |                                                                                                           |                   |
|------------------------------------------------|------------------|-------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-------------------|
| STEP                                           | MEASURE          | SIGNAL                                                                                                      | ABNORMAL INDICATION                                                                                       | NORMAL INDICATION |
| FUNCTION/SYMPOM: C1D1 Pulse                    |                  | OPERATIONS: Mode C, No Code,                                                                                |                                                                                                           | MASTER to NORM    |
|                                                |                  | Appears No Input                                                                                            |                                                                                                           |                   |
| 1                                              | A5TP2            | 0.6v<br><br>0.2v           | <br><br>Go to step 2.    |                   |
| 2                                              | Base Q6          | 0.6v<br><br>-0.7v          | -0.7 vdc.<br><br>Check transistor Q6 and associated components. Replace as required.<br><br>Go to step 3. |                   |
| 3                                              | Emitter Q3       | 8.0v<br><br>0.8v<br>0.4v | 2 vdc.<br><br>Check diodes CR31-CR35, CR41. Replace as required.<br><br>Go to step 6.                     |                   |
| 4                                              | Base Q3          | 9.0v<br><br>1.5v<br>1.0v | 8.6 vdc.<br><br>Check transistor Q3, diode CR25. Replace as required.                                     | Go to step 5.     |
| 5                                              | Anode diode CR30 | 2.4v<br><br>0.3v<br>0.2v | 0.6 vdc.<br><br>Check capacitor C2. Replace as required.                                                  | Go to step 6.     |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

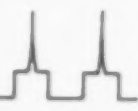
| CIRCUIT CARD: Encoder Control (A5)- Continued   |                |                                                                                                             |                                                                                                                                                                         |                   |
|-------------------------------------------------|----------------|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| STEP                                            | MEASURE        | SIGNAL                                                                                                      | ABNORMAL INDICATION                                                                                                                                                     | NORMAL INDICATION |
| FUNCTION/SYMPOM: C1D1 Pulse<br>Appears No Input |                | OPERATIONS: Mode C, No Code,<br>MASTER to NORM                                                              |                                                                                                                                                                         |                   |
| 6                                               | Emitter<br>Q4  | 9.0v<br><br>0.2v           | 2 vdc.<br><br>Check diodes CR31-<br>CR35, CR48. Replace<br>as required.<br><br>Go to step 7.                                                                            |                   |
| 7                                               | Base Q4        | 9.6v<br><br>0.8v           | 8.6 vdc.<br><br>Check transistor Q4,<br>diode CR28. Replace<br>as required.                                                                                             |                   |
| FUNCTION/SYMPOM: No 7700 Code<br>In Emergency   |                | OPERATIONS: Mode 3/A, Code 0000,<br>MASTER to EMER                                                          |                                                                                                                                                                         |                   |
| 1                                               | A5TP3<br>A5TP4 | 4.5v<br><br>1.4v<br>0.8v | 0.6v<br>0.2v<br><br><br>Go to step 2.                                               |                   |
| 2                                               | A5TP7          | 4.5v<br><br>0.6v<br>0.2v | <br><br>Check diode CR24 and<br>associated compo-<br>nents. Replace as<br>required. | Go to step 4.     |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

| CIRCUIT CARD: Encoder Control (A5) - Continued |                         |                                                                                                                                     |                                                                                                                                                                      |                                        |
|------------------------------------------------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| STEP                                           | MEASURE                 | SIGNAL                                                                                                                              | ABNORMAL INDICATION                                                                                                                                                  | NORMAL INDICATION                      |
| FUNCTION/SYMPOM:                               |                         | No 7700 Code<br>In Emergency                                                                                                        | OPERATIONS:                                                                                                                                                          | Mode 3/A, Code 0000,<br>MASTER to EMER |
| 3                                              | A5TP10                  | 4.5v<br>0.6v<br>0.2v<br>                           | <br><br>Check diode CR23 and<br>associated compo-<br>nents. Replace as<br>required. | Go to step 5.                          |
| 4                                              | A5TP7<br><br>A5TP1      | Same as step<br>2.<br><br>8.5v<br>0v<br><br>72 μs | <br><br>Check diodes CR7,<br>CR8, CR24. Replace<br>as required.                     |                                        |
| 5                                              | A5TP10<br><br>A5TP1     | Same as step<br>3.<br><br>Same as step<br>4.                                                                                        | <br><br>Check diodes CR6,<br>CR9, CR23. Replace<br>as required.                   |                                        |
| FUNCTION/SYMPOM:                               |                         | Code 7777<br>In Emergency                                                                                                           | OPERATIONS:                                                                                                                                                          | Mode 3/A, Code 0000,<br>MASTER to EMER |
| 1                                              | A5TP2<br>A5TP8<br>A5TP5 | 0.2v<br>0v<br>                                   | <br><br>Go to step 2.                                                             |                                        |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

| CIRCUIT CARD: Encoder Control (A5) - Continued                                            |               |                                                                                                                           |                                                            |                                                     |
|-------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|-----------------------------------------------------|
| STEP                                                                                      | MEASURE       | SIGNAL                                                                                                                    | ABNORMAL INDICATION                                        | NORMAL INDICATION                                   |
| FUNCTION/SYMPOM: Code 7777<br>In Emergency                                                |               | OPERATIONS: Mode 3/A, Code 0000,<br>MASTER to EMER                                                                        |                                                            |                                                     |
| 2                                                                                         | A5TP6         |  <p>8.6v<br/>0v</p>                      | <p>1 vdc.</p> <p>Check encoder gating (A6).</p>            | Check resistors R81, R82, R83. Replace as required. |
| CIRCUIT CARD: Endocer Gating (A6)                                                         |               | Reference figures 6-14 or 6-15 and 6-34                                                                                   |                                                            |                                                     |
| FUNCTION/SYMPOM: 2 <sup>4</sup> , 2 <sup>5</sup> , 2 <sup>6</sup><br>Counters Inoperative |               | OPERATIONS: Mode 2, Code 0000, STBY                                                                                       |                                                            |                                                     |
| 1                                                                                         | TP10          |  <p>9.7v<br/>0v</p>                      | <p>9.75 vdc.</p> <p>Go to step 2.</p>                      | Go to step 4.                                       |
| 2                                                                                         | Base Q17      |  <p>0v<br/>-5.6v<br/>0.6v<br/>0.5v</p> | <p>-0.5 vdc.</p> <p>Replace Q17.</p>                       | Go to step 3.                                       |
| 3                                                                                         | Collector Q16 |  <p>9.7v<br/>0.6v</p>                  | <p>Ground.</p> <p>Check Q16 and associated components.</p> | Go to step 4.                                       |
| 4                                                                                         | Collector Q9  |  <p>9v<br/>0v</p>                      | <p>9 vdc.</p> <p>Go to step 5.</p>                         | Go to step 7.                                       |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

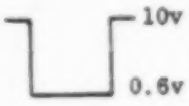
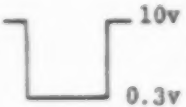
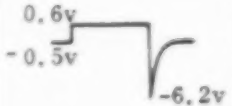
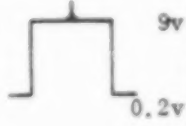
| CIRCUIT CARD: Encoder Gating (A6) - Continued                                              |              |                                                                                     |                                                |                   |
|--------------------------------------------------------------------------------------------|--------------|-------------------------------------------------------------------------------------|------------------------------------------------|-------------------|
| STEP                                                                                       | MEASURE      | SIGNAL                                                                              | ABNORMAL INDICATION                            | NORMAL INDICATION |
| FUNCTION/SYMPTOM: 2 <sup>4</sup> , 2 <sup>5</sup> , 2 <sup>6</sup><br>Counters Inoperative |              | OPERATIONS: Mode 2, Code 0000,<br>EMER                                              |                                                |                   |
| 5                                                                                          | Base Q9      |    | -0.5 vdc.<br>Replace Q9.                       | Go to step 6.     |
| 6                                                                                          | Collector Q8 |    | Ground.<br>Check Q8 and associated components. | Go to step 7.     |
| 7                                                                                          | TP7          |   | 10 vdc.<br>Go to step 8.                       | Go to step 8.     |
| 8                                                                                          | Base Q1      |  | -0.5 vdc.<br>Replace Q8.                       | Go to step 9.     |
| 9                                                                                          | Collector Q2 |  | Ground.<br>Check Q2 and associated components. |                   |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure- Continued

| CIRCUIT CARD: Encoder Gating (A6) - Continued                                                           |                   |        |                           |                                                                                      |
|---------------------------------------------------------------------------------------------------------|-------------------|--------|---------------------------|--------------------------------------------------------------------------------------|
| STEP                                                                                                    | MEASURE           | SIGNAL | ABNORMAL INDICATION       | NORMAL INDICATION                                                                    |
| FUNCTION/SYMPOM: No Reset Pulse    OPERATIONS: Mode 2, Code 0000,<br>STBY Q8 at 10V, TP7 10V, TP8 11.8V |                   |        |                           |                                                                                      |
| 1                                                                                                       | TP5               |        | 0 vdc.<br>Go to step 2.   | Go to step 2.                                                                        |
| 2                                                                                                       | ANODE<br>CR41     |        | 7.9 vdc.<br>Go to step 3. | Check capacitor C7, diodes CR3, CR17, CR31, resistors R10, R13. Replace as required. |
| 3                                                                                                       | Collec-<br>tor Q3 |        | 6 vdc.<br>Go to step 4.   | Replace diode CR41.                                                                  |
| 4                                                                                                       | Base Q3           |        | 0.6 vdc.<br>Go to step 5. | Replace transistor Q3.                                                               |
| 5                                                                                                       | Collec-<br>tor Q4 |        | 5 vdc.<br>Go to step 6.   |                                                                                      |
| 6                                                                                                       | Base Q4           |        |                           | Check transistor Q4 and associated components. Replace as required.                  |



Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

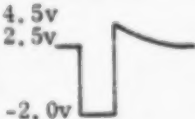
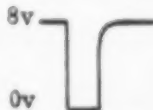
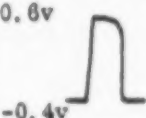
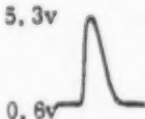
| CIRCUIT CARD: Encoder Gating (A6) - Continued |               |                                                                                     |                                                                                       |                                                                  |
|-----------------------------------------------|---------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|------------------------------------------------------------------|
| STEP                                          | MEASURE       | SIGNAL                                                                              | ABNORMAL INDICATION                                                                   | NORMAL INDICATION                                                |
| FUNCTION/SYMPOM: No Auxiliary Reset           |               | OPERATIONS: Mode 2, Code 0000, STBY Ground A4TP5, A6TP3                             |                                                                                       |                                                                  |
| 1                                             | A6TP8         |    | 11.8 vdc.<br>Go to step 2.                                                            | Check diode CR8.<br>Replace if required.                         |
| 2                                             | Collector Q18 |    | 12 vdc.<br>Go to step 3.                                                              | Check diode CR25,<br>resistors R50, R51.<br>Replace as required. |
| 3                                             | Base Q18      |   | Ground.<br>Check diodes CR33,<br>CR35, resistors<br>R67, R68. Replace<br>as required. | Replace transistor<br>Q18.<br>Go to step 4.                      |
| 4                                             | Collector Q10 |  | 8 vdc.<br>Go to step 5.                                                               | Check capacitor C15.<br>Replace if required.                     |
| 5                                             | Base Q10      |  | -0.4 vdc.<br>Go to step 6.                                                            | Replace transistor<br>Q10.                                       |
| 6                                             | Anode CR21    |  | Ground.<br>Go to step 7.                                                              |                                                                  |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

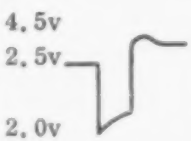
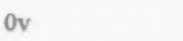
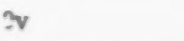
| CIRCUIT CARD: Encoder Gating (A6) - Continued |                                     |                                                                                                                                                                                              |                                                                                                              |                                                                                  |
|-----------------------------------------------|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| STEP                                          | MEASURE                             | SIGNAL                                                                                                                                                                                       | ABNORMAL INDICATION                                                                                          | NORMAL INDICATION                                                                |
| FUNCTION/SYMPOM:                              |                                     | No Auxiliary Reset                                                                                                                                                                           | OPERATIONS:                                                                                                  | Mode 2, Code 0000, STBY Ground A4TP5, A6TP3                                      |
| 7                                             | Collector Q9                        |                                                                                                             | Ground.<br>Check 2 <sup>5</sup> counter, transistors Q8, Q9, and associated components. Replace as required. | Check diode CR23, resistors R44, R45, R47. Replace as required.<br>Go to step 8. |
| 8                                             | A6TP8<br>Interr-<br>gate in<br>M3/A |                                                                                                            | 11.8 vdc.<br>Check diodes CR34, CR12. Replace as required.                                                   |                                                                                  |
| FUNCTION/SYMPOM:                              |                                     | No I/D Operation                                                                                                                                                                             | OPERATIONS:                                                                                                  | Mode 2, Code 0000, MASTER to STBY                                                |
| 1                                             | A6TP3                               |                                                                                                           | 11.6 vdc.<br>Go to step 2.                                                                                   |                                                                                  |
| 2                                             | Base Q19                            | <br><br>(15 to 30 sec) | Ground.<br>Go to step 3.                                                                                     | Replace transistor Q19.                                                          |
| 3                                             | Cathode CR36                        | <br>                   | Ground.<br>Replace capacitor C9.                                                                             | Go to step 4.                                                                    |
| 4                                             | Collector Q20                       | <br><br>(15 to 30 sec) | Ground.<br>Go to step 5.                                                                                     |                                                                                  |

Table 3-10 Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

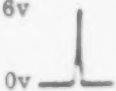
| CIRCUIT CARD: Encoder Gating (A6) - Continued |                             |                                                                                                           |                                                                                                  |                                                                                 |
|-----------------------------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| STEP                                          | MEASURE                     | SIGNAL                                                                                                    | ABNORMAL INDICATION                                                                              | NORMAL INDICATION                                                               |
| FUNCTION/SYMPTOM:                             |                             | No I/P<br>Operation                                                                                       | OPERATIONS:                                                                                      | Mode 2, Code 0000,<br>MASTER to STBY                                            |
| 5                                             | Base<br>Q20                 | 0v<br><br>-1v            | 0.6 vdc.<br><br>Go to step 6.                                                                    | Replace transistor<br>Q20.                                                      |
| 6                                             | Collec-<br>tor Q2-          | 0v<br><br>(15 to 30 sec) | 15.4 vdc.<br><br>Check transistor<br>Q21 and associated<br>components. Re-<br>place as required. | Check transistor Q22<br>and associated com-<br>ponents. Replace as<br>required. |
| FUNCTION/SYMPTOM:                             |                             | No Emergency<br>Operation                                                                                 | OPERATIONS:                                                                                      | Mode 2 Steps 1-5,<br>Mode 3/A Steps 6-9,<br>Code 0000, EMER                     |
| 1                                             | A6TP2<br><br>M-3/A          | 10v<br><br>0v          | Ground.<br><br>Go to step 2.                                                                     | Go to step 4.                                                                   |
| 2                                             | Base Q5<br><br>M-3/A        | 0v<br><br>-0.7v        | 0.6 vdc.<br><br>Go to step 3.                                                                    | Replace transistor<br>Q5.                                                       |
| 3                                             | Cathode<br>CR9<br><br>M-3/A | 6v<br><br>0v           |                                                                                                  | Replace diode CR9.                                                              |

Table 3-10. Functional Troubleshooting Chart,  
Extender Board Procedure - Continued

| CIRCUIT CARD: Encoder Gating (A6) - Continued |               |                                                                                          |                                                                    |                                                             |
|-----------------------------------------------|---------------|------------------------------------------------------------------------------------------|--------------------------------------------------------------------|-------------------------------------------------------------|
| STEP                                          | MEASURE       | SIGNAL                                                                                   | ABNORMAL INDICATION                                                | NORMAL INDICATION                                           |
| FUNCTION/SYMPOM:                              |               | No Emergency Operation                                                                   | OPERATIONS:                                                        | Mode 2 Steps 1-5,<br>Mode 3/A Steps 6-9,<br>Code 0000, EMER |
| 4                                             | A6TP1         | 8.8v    | Ground.                                                            | Go to step 6.                                               |
|                                               | M-3/A         | 0v                                                                                       | Go to step 5.                                                      |                                                             |
| 5                                             | Base Q6       | 9.6v    | Ground.                                                            | Replace transistor Q6.                                      |
|                                               | M-3/A         | 0v                                                                                       | Check diodes CR10, CR11, CR13. Replace as required.                |                                                             |
| 6                                             | A6TP1         | 7.6v    | Ground.                                                            |                                                             |
|                                               | M-2           | 0v                                                                                       | Go to step 7.                                                      |                                                             |
| 7                                             | A6TP4         | 9.6v  | 9.6 vdc.                                                           | Check transistor Q7, diode CR10. Replace as required.       |
|                                               | M-2           | 0v                                                                                       | Go to step 8.                                                      |                                                             |
| 8                                             | Collector Q15 | 9.6v  | 9.6 vdc.                                                           | Check diode CR29 and replace if required.                   |
|                                               |               | 0v                                                                                       | Go to step 9.                                                      |                                                             |
| 9                                             | Base Q15      | 0.6v  | -0.5 vdc.                                                          | Replace transistor Q15.                                     |
|                                               |               | -0.8v                                                                                    | Check transistor Q14 and associated circuits. Replace as required. |                                                             |
|                                               |               | -3v                                                                                      |                                                                    |                                                             |

b. *In-Circuit Procedure.* The test and terminal points of A7 modulator, A8 sensitivity, AR1 rf amplifier, AR2 power amplifier, and Z2 oscillator

subassemblies are readily available for troubleshooting without the need for disassembly or removal from circuit.

Table 3-11. Functional Troubleshooting Chart, In-Circuit Procedure

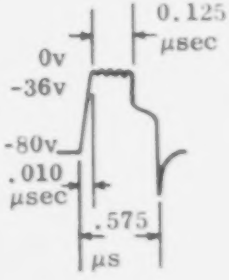
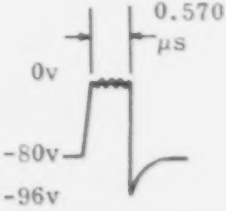
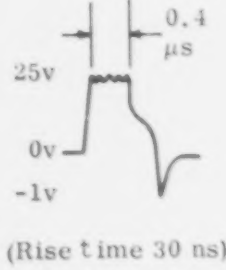
| CIRCUIT CARD: Modulator (A7) |                            |                                                                                     |                                                                                                                |                                               |
|------------------------------|----------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| STEP                         | MEASURE                    | SIGNAL                                                                              | ABNORMAL INDICATION                                                                                            | NORMAL INDICATION                             |
| FUNCTION/SYMPOM: No Output   |                            | OPERATIONS: Mode 2, Code 7777, MASTER to NORM                                       |                                                                                                                |                                               |
| 1                            | Z2-2<br>(Oscillator input) |    | -1 vdc or ground.<br>Check resistors R15-R19, transistor Q5. Replace as required.<br>-80 vdc.<br>Go to step 2. |                                               |
| 2                            | Base Q5                    |   | -80 vdc.<br>Go to step 3.                                                                                      |                                               |
| 3                            | Emitter Q4                 |  | 25 vdc.<br>Replace transistor Q4.<br>Ground.<br>Go to step 4.                                                  | Check transformer T1 and replace if required. |

Table 3-11. Functional Troubleshooting Chart, In-Circuit Procedure  
- Continued

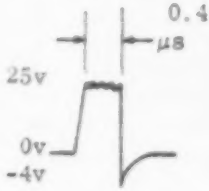
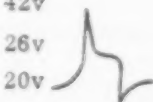
| CIRCUIT CARD: Modulator (A7)- Continued    |              |                                                                                     |                                                                                                                                                                               |                                               |
|--------------------------------------------|--------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| STEP                                       | MEASURE      | SIGNAL                                                                              | ABNORMAL INDICATION                                                                                                                                                           | NORMAL INDICATION                             |
| FUNCTION/SYMPOM: No Output                 |              |                                                                                     | OPERATIONS: Mode 2, Code 7777, MASTER to NORM                                                                                                                                 |                                               |
| 4                                          | Base Q4      |    | Ground.<br>Check thermistor RT1, resistors R3, R5. Replace as required.<br>Go to step 5.                                                                                      | Replace transistor Q4.                        |
| 5                                          | Collector Q1 |    | 25 vdc.<br>Check transistor Q1, diodes CR1, CR2, capacitor C1. Replace as required.<br>Ground.<br>Check resistor R1, capacitors C7, C8. Replace as required.<br>Go to step 6. | Check transformer T2 and replace if required. |
| 6                                          | Base Q1      |  | 0 vdc.<br>Check resistors R1-R4. Replace as required.                                                                                                                         |                                               |
| CIRCUIT CARD: Sensitivity (A8)             |              |                                                                                     |                                                                                                                                                                               |                                               |
| FUNCTION/SYMPOM: No Output<br>STBY or NORM |              |                                                                                     | OPERATIONS: Mode 2, Code 0000, -90 dbv, MASTER to STBY                                                                                                                        |                                               |
| 1a                                         | A8-1         |  | Negative dc level.<br>Check capacitor C1. Replace if required.                                                                                                                | Go to step 1b.                                |
| 1b                                         | A8-3         |  | 28 vdc.<br>Check filter FL12. Replace if required.                                                                                                                            | Go to step 2a.                                |



Table 3-11. Functional Troubleshooting Chart, In-Circuit Procedure  
- Continued

| CIRCUIT CARD: Sensitivity (A8) - Continued                                           |                                              |                         |                                                                                                |                   |
|--------------------------------------------------------------------------------------|----------------------------------------------|-------------------------|------------------------------------------------------------------------------------------------|-------------------|
| STEP                                                                                 | MEASURE                                      | SIGNAL                  | ABNORMAL INDICATION                                                                            | NORMAL INDICATION |
| FUNCTION/SYMP TOM: No Output<br>STBY or NORM                                         |                                              |                         | OPERATIONS: Mode 2, Code 0000,<br>-90 dbv, MASTER to<br>STBY                                   |                   |
| 2a                                                                                   | A8-6<br>A8-7<br>A8-8                         | 0v<br><br>-110v _____   | Ground.<br>Go to step 2b.                                                                      |                   |
| 2b                                                                                   | A8-7                                         | 0v<br><br>-109v _____   | Ground.<br>Go to step 2c.                                                                      |                   |
| 2c                                                                                   | A8-8                                         | 0v<br><br>-108.5v _____ | Ground.<br>Check resistors R1-<br>R3, R6, capacitor<br>C4, relay K1. Re-<br>place as required. | Go to step 3.     |
| 3                                                                                    | A8-5<br><br>No<br>jamming                    | 0v<br><br>-110v _____   | 0 vdc.<br>Go to step 4.                                                                        |                   |
| Turn MASTER to OFF. Use ohmmeter for following test, observing polarities indicated. |                                              |                         |                                                                                                |                   |
| 4                                                                                    | A8-5 <sup>+</sup><br>to<br>A8-4 <sup>-</sup> | 100k ohms               | Less than 100k ohms.<br>Check capacitors<br>C2, C3. Replace<br>as required.                    | Go to step 5.     |
| 5                                                                                    | A8-5 <sup>-</sup><br>to<br>A8-9 <sup>+</sup> | 0.3 megohm              | Less than 0.3<br>megohm to 0.6<br>megohm.<br>Check capacitor C4.<br>Replace as required.       | Go to step 6.     |

Table 3-11. Functional Troubleshooting Chart, In-Circuit Procedure  
- Continued

| CIRCUIT CARD: Sensitivity (A8) - Continued                                                     |                                                                                            |                           |                                                                     |                   |
|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|---------------------------|---------------------------------------------------------------------|-------------------|
| STEP                                                                                           | MEASURE                                                                                    | SIGNAL                    | ABNORMAL INDICATION                                                 | NORMAL INDICATION |
| Turn MASTER to OFF. Use ohmmeter for following test, observing polarities indicated.           |                                                                                            |                           |                                                                     |                   |
| 6                                                                                              | A8-4 <sup>-</sup> to Anode CR2 <sup>+</sup><br>A8-4 <sup>+</sup> to Anode CR2 <sup>-</sup> | 7.5k ohms<br><br>60k ohms | 2.4k ohms. Check diode CR2.<br><br>35k ohms. Replace if required.   | Go to step 7.     |
| 7                                                                                              | A8-4 <sup>-</sup> to Anode CR1 <sup>+</sup><br>A8-4 <sup>+</sup> to Anode CR1 <sup>-</sup> | 2.4k ohms<br><br>35k ohms | 0 ohm.<br><br>Check diode CR1. Replace if required.                 | Go to step 8.     |
| 8                                                                                              | A8-1 <sup>+</sup> to -<br>A8-4 <sup>-</sup>                                                | 200k ohms                 | 2.4k ohms. Check capacitor C1. Replace if required.                 |                   |
| FUNCTION/SYMPTOM: No Output in LOW      OPERATIONS: Mode 2, Code 0000, -90 dbv, MASTER to STBY |                                                                                            |                           |                                                                     |                   |
| 1                                                                                              | A8-3                                                                                       | 28v _____<br><br>0v       | Ground.<br>Check relay K1 and diode CR3. Replace as required.       | Go to step 2.     |
| 2                                                                                              | A8-6<br>A8-7<br>A8-8                                                                       | 0v<br><br>-110v _____     | Ground.<br>Check resistors R1, R2, R3, and R5. Replace as required. |                   |

Table 3-11. Functional Troubleshooting Chart, In-Circuit Procedure  
- Continued

RECEIVER [RF AMPLIFIER (AR1), PRESELECTOR (Z1)]

FUNCTION/SYMPOM: No Output or Low Gain OPERATIONS: Mode 2, Code 0000, MASTER to STBY

| STEP | PROCEDURE                       |       |            |
|------|---------------------------------|-------|------------|
| 1    | Check filament voltages         | AR1-2 | 6.3 vdc    |
|      |                                 | AR1-5 | 6.3 vdc    |
|      |                                 | AR1-8 | 6.3 vdc    |
| 2    | Check grid voltage              | AR1-7 | -110 vdc   |
| 3    | Check grid voltage (no jamming) | AR1-1 | -110 vdc   |
| 4    | Check cathode voltages          | AR1-3 | -110 vdc   |
|      |                                 | AR1-6 | -109 vdc   |
|      |                                 | AR1-9 | -108.5 vdc |

NOTE

Determine defective Z1 or AR1 by substituting known serviceable part.

Table 3-11 Functional Troubleshooting Chart, In-Circuit Procedure  
- Continued

RECEIVER [RF AMPLIFIER (AR1), PRESELECTOR (Z1)]

FUNCTION/SYMPTOM: No Output or Low Gain      OPERATIONS: Mode 2, Code 0000, MASTER to STBY

| STEP | PROCEDURE                                                                                                      |
|------|----------------------------------------------------------------------------------------------------------------|
| 1    | If output pulse is not correct, disconnect W2 from Z1 and connect AN/URM-64A through 10-db pad to input of Z1. |
| 2    | Output pulse at AR3TP1 should increase approximately 0.3 volts.                                                |
| 3    | If increase in $\delta f$ is greater than 0.3 volt, check CP1, W2, Z3, W1, and J2.                             |
| 4    | If pulse amplitude at AR3TP1 is less than 1.8 volts minimum, replace Z1 or AR1.                                |

NOTE

Determine defective Z1 or AR1 by substituting known serviceable part.

TRANSMITTER [AMPLIFIER (AR2), OSCILLATOR (Z2)]

FUNCTION/SYMPTOM: No Output or Low Output      OPERATIONS: Mode 2, Code 7777, MASTER to NORM

| STEP  | PROCEDURE                                                                                                                                                                                                                     |       |         |      |         |       |         |       |         |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------|------|---------|-------|---------|-------|---------|
| 1     | Check filament voltages <table border="0"> <tr> <td>Z2-3</td> <td>6.3 vdc</td> </tr> <tr> <td>Z2-4</td> <td>6.3 vdc</td> </tr> <tr> <td>AR2-1</td> <td>6.3 vdc</td> </tr> <tr> <td>AR2-2</td> <td>6.3 vdc</td> </tr> </table> | Z2-3  | 6.3 vdc | Z2-4 | 6.3 vdc | AR2-1 | 6.3 vdc | AR2-2 | 6.3 vdc |
| Z2-3  | 6.3 vdc                                                                                                                                                                                                                       |       |         |      |         |       |         |       |         |
| Z2-4  | 6.3 vdc                                                                                                                                                                                                                       |       |         |      |         |       |         |       |         |
| AR2-1 | 6.3 vdc                                                                                                                                                                                                                       |       |         |      |         |       |         |       |         |
| AR2-2 | 6.3 vdc                                                                                                                                                                                                                       |       |         |      |         |       |         |       |         |
| 2     | Check cathode voltages <table border="0"> <tr> <td>AR2-3</td> <td>25 vdc</td> </tr> </table>                                                                                                                                  | AR2-3 | 25 vdc  |      |         |       |         |       |         |
| AR2-3 | 25 vdc                                                                                                                                                                                                                        |       |         |      |         |       |         |       |         |
| 3     | Check Z2-2 for a positive-going waveform from -80V to 0V.                                                                                                                                                                     |       |         |      |         |       |         |       |         |
| 4     | Check plate voltage for 1000 vdc.                                                                                                                                                                                             |       |         |      |         |       |         |       |         |

c. Out of Circuit Procedure. Detector and Video Amplifier AR3, Delay Line DL1, and Power Supply PS1 must be removed from the RT-859A/APX-72

to perform troubleshooting procedures prescribed in table 3-12.

Table 3-12. Functional Troubleshooting Chart,  
Out of Circuit Procedure

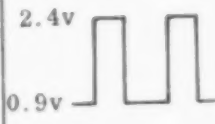
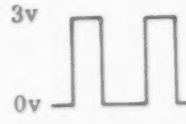
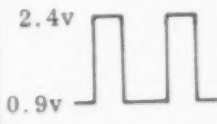
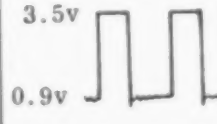
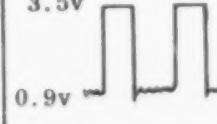
| CIRCUIT CARD: Detector and Video Amplifier (AR3)<br>(Part No. 4023409-0501, 0502) |             |                                                                                     |                                                                     |                                                    |
|-----------------------------------------------------------------------------------|-------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------|----------------------------------------------------|
| STEP                                                                              | MEASURE     | SIGNAL                                                                              | ABNORMAL INDICATION                                                 | NORMAL INDICATION                                  |
| FUNCTION/SYMPOM: No Log Video Output                                              |             | OPERATIONS: Mode 2, Code 0000<br>MASTER to STBY                                     |                                                                     |                                                    |
| 1                                                                                 | AR3TP1      |    | Ground.<br>Go to step 2.                                            | Go to step 3.                                      |
| 2                                                                                 | Base Q1     |    | Ground.<br>Check detector and replace if required.                  | Check transistors Q1 and Q2. Replace if defective. |
| 3                                                                                 | A5-7        |  | Ground.<br>Check capacitor C15, resistor R51. Replace if defective. | Go to step 4.                                      |
| 4                                                                                 | Base Q10    |  | Ground.<br>Replace CA3005 A5.                                       | Go to step 5.                                      |
| 5                                                                                 | Emitter Q10 |  | Ground.<br>Replace transistor Q10.                                  | Go to step 6.                                      |

Table 3-12. Functional Troubleshooting Chart,  
Out of Circuit Procedure - Continued

| CIRCUIT CARD: Detector and Video Amplifier (AR3)<br>(Part No. 4023409-0501, 0502) - Continued |                               |                                                                                                    |                                                                                                 |                   |
|-----------------------------------------------------------------------------------------------|-------------------------------|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------|
| STEP                                                                                          | MEASURE                       | SIGNAL                                                                                             | ABNORMAL INDICATION                                                                             | NORMAL INDICATION |
| FUNCTION/SYMPTOM: No Log Video Output                                                         |                               | OPERATIONS: Mode 2, Code 0000<br>MASTER to STBY                                                    |                                                                                                 |                   |
| 6                                                                                             | Emitter Q11                   | 1.07v <br>0.9v    | Ground.<br>Check capacitor C17, resistors R57, R60, R61. Replace as required.<br>Go to step 10. | Go to step 7.     |
| 7                                                                                             | Collector Q11                 | 1.79v <br>0.9v    | Ground.<br>Replace transistor Q11.                                                              | Go to step 8.     |
| 8                                                                                             | Emitter Q12                   | 1.74v <br>0.9v  | Ground.<br>Replace transistor Q12.                                                              | Go to step 9.     |
| 9                                                                                             | AR3TP4                        | 1.2v <br>1v     | Ground.<br>Replace transistor Q13.                                                              |                   |
| 10                                                                                            | Emitter Q7<br><br>Ground A4-7 | 0.3v <br><br>0v | Ground.<br>Go to step 11.                                                                       | Go to step 12.    |



Table 3-12. Functional Troubleshooting Chart,  
Out of Circuit Procedure - Continued

| CIRCUIT CARD: Detector and Video Amplifier (AR3)<br>(Part No. 4023409-0501, 0502) - Continued |                               |                                                 |                               |                        |
|-----------------------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------|-------------------------------|------------------------|
| STEP                                                                                          | MEASURE                       | SIGNAL                                          | ABNORMAL INDICATION           | NORMAL INDICATION      |
| FUNCTION/SYMPOM: No Log Video Output                                                          |                               | OPERATIONS: Mode 2, Code 0000<br>MASTER to STBY |                               |                        |
| 11                                                                                            | Base Q7<br><br>Ground A4-7    | 1v _____<br><br>0v                              | Ground.<br>Replace CA3005 A4. | Replace transistor Q7. |
| 12                                                                                            | Emitter Q6<br><br>Ground A3-7 | 0.3v _____<br><br>0v                            | Ground.<br>Go to step 13.     | Go to step 14.         |
| 13                                                                                            | Base Q6<br><br>Ground A3-7    | 1v _____<br><br>0v                              | Ground.<br>Replace CA3005 A3. | Replace transistor Q7. |
| 14                                                                                            | Emitter Q5<br><br>Ground A2-7 | 0.3v _____<br><br>0v                            | Ground.<br>Go to step 15.     | Go to step 16.         |
| 15                                                                                            | Base Q5<br><br>Ground A2-7    | 1v _____<br><br>0v                              | Ground.<br>Replace CA3005 A2. | Replace transistor Q5. |

Table 3-12. Functional Troubleshooting Chart,  
Out of Circuit Procedure - Continued

| CIRCUIT CARD: Detector and Video Amplifier (AR3)<br>(Part No. 4023409-0501, 0502) - Continued |                                                         |                      |                                                                 |                           |
|-----------------------------------------------------------------------------------------------|---------------------------------------------------------|----------------------|-----------------------------------------------------------------|---------------------------|
| STEP                                                                                          | MEASURE                                                 | SIGNAL               | ABNORMAL INDICATION                                             | NORMAL INDICATION         |
| FUNCTION/SYMPOM: No Log Video<br>Output                                                       |                                                         |                      | OPERATIONS: Mode 2, Code 0000<br>MASTER to STBY                 |                           |
| 16                                                                                            | Emitter<br>Q4<br><br>Ground<br>A1-7                     | 0.3v _____<br><br>0v | Ground.<br><br>Go to step 17.                                   | Go to step 18.            |
| 17                                                                                            | Base Q4<br><br>Ground<br>A1-7                           | 1v _____<br><br>0v   | Ground.<br>Replace CA3005 A1.                                   | Replace transistor<br>Q4. |
| 18                                                                                            | Emitter<br>Q3<br>Ground<br>junction<br>R29,<br>R28, C11 | 0.3v _____<br><br>0v | Ground.<br><br>Go to step 19.                                   |                           |
| 19                                                                                            | Base Q3<br><br>Ground<br>junction<br>R29,<br>R28, C11   | 1v _____<br><br>0v   | Ground.<br>Check transistors<br>Q1, Q2. Replace<br>as required. | Replace transistor<br>Q3. |

Table 3-12. Functional Troubleshooting Chart,  
Out of Circuit Procedure - Continued

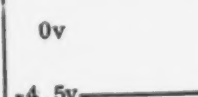
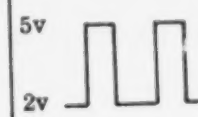
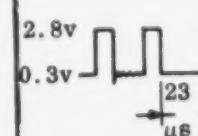
| CIRCUIT CARD: Detector and Video Amplifier (AR3)<br>(Part No. 4023409-0501, 0502) - Continued |              |                                                                                     |                                                                                                 |                        |
|-----------------------------------------------------------------------------------------------|--------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------|
| STEP                                                                                          | MEASURE      | SIGNAL                                                                              | ABNORMAL INDICATION                                                                             | NORMAL INDICATION      |
| FUNCTION/SYMPOM: No Bias Voltage      OPERATIONS: Mode 2, Code 0000<br>MASTER to STBY         |              |                                                                                     |                                                                                                 |                        |
| 1                                                                                             | AR3TP2       |    | Ground.<br>Check transistor Q14, $\mu$ L710 A6, and associated components. Replace as required. |                        |
| 2                                                                                             | AR3TP3       |    | Ground.<br>Check transistor Q15, $\mu$ L710 A7, and associated components. Replace as required. |                        |
| FUNCTION/SYMPOM: No Anti-Jam      OPERATIONS: Mode 2, Code 0000<br>MASTER to STBY             |              |                                                                                     |                                                                                                 |                        |
| 1                                                                                             | Collector Q9 |  | Ground.<br>Go to step 2.                                                                        |                        |
| 2                                                                                             | Emitter Q9   |  | Ground.<br>Go to step 3.                                                                        | Replace transistor Q9. |

Table 3-12. Functional Troubleshooting Chart,  
Out of Circuit Procedure - Continued

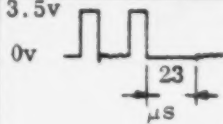
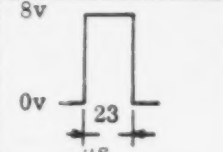
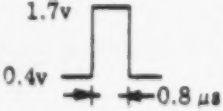
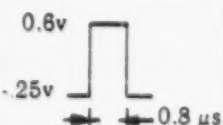
| CIRCUIT CARD: Detector and Video Amplifier (AR3)<br>(Part No. 4023409-0501, 0502) - Continued                                                             |          |                                                                                     |                                                                             |                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| STEP                                                                                                                                                      | MEASURE  | SIGNAL                                                                              | ABNORMAL INDICATION                                                         | NORMAL INDICATION                                                                 |
| FUNCTION/SYMPOM: No Anti-Jam                                                                                                                              |          |                                                                                     | OPERATIONS: Mode 2, Code 0000<br>MASTER to STBY                             |                                                                                   |
| 3                                                                                                                                                         | Base Q8  |    | Ground.<br><br>Check capacitor C11, resistor R40. Re-<br>place as required. | Replace transistor<br>Q9.<br><br>No 23 μsec blank-<br>ing pulse, go to<br>step 4. |
| 4                                                                                                                                                         | Base Q16 |    |                                                                             | Check transistor<br>Q16 and diode CR2.<br>Replace as required.                    |
| CIRCUIT CARD: Detector and Video Amplifier (AR3)<br>(Part No. 4023409-0503)                                                                               |          |                                                                                     |                                                                             |                                                                                   |
| STEP                                                                                                                                                      | MEASURE  | SIGNAL                                                                              | ABNORMAL INDICATION                                                         | NORMAL INDICATION                                                                 |
| FUNCTION/SYMPOM: No Log Video<br>Output                                                                                                                   |          |                                                                                     | OPERATIONS: Mode 2, Code 0000<br>MASTER to STBY                             |                                                                                   |
| NOTE<br><br>Prior to performing step 1 adjust OUTPUT<br>ATTEN 0-100 dBm control to 0. Increase<br>attenuation only if observed pulses show<br>saturation. |          |                                                                                     |                                                                             |                                                                                   |
| 1                                                                                                                                                         | TP1      |  | Go to step 2.                                                               | Go to step 3.                                                                     |
| 2                                                                                                                                                         | E1       |  | Check detector and<br>replace if required.                                  | Check transistor<br>Q1 and associated<br>components. Re-<br>place as required.    |

Table 3-12. Functional Troubleshooting Chart,  
Out of Circuit Procedure - Continued

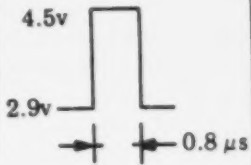
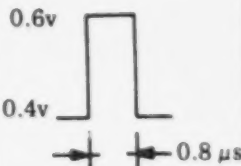
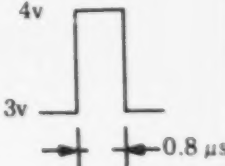
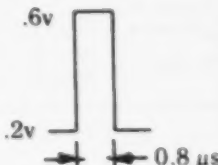
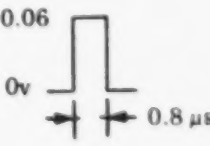
| CIRCUIT CARD: Detector and Video Amplifier (AR3)<br>(Part No. 4023409-0503) - Continued |         |                                                                                     |                                                                     |                                                          |
|-----------------------------------------------------------------------------------------|---------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------|----------------------------------------------------------|
| STEP                                                                                    | MEASURE | SIGNAL                                                                              | ABNORMAL INDICATION                                                 | NORMAL INDICATION                                        |
| FUNCTION/SYMP TOM: No Log Video Output                                                  |         | OPERATIONS: Mode 2, Code 0000<br>MASTER to STBY                                     |                                                                     |                                                          |
| 3                                                                                       | TP2     |    | Go to step 4.                                                       | Go to step 5.                                            |
| 4                                                                                       | U2-1    |    | Check transistor Q2 and associated components. Replace as required. | Check U2 and associated components. Replace as required. |
| 5                                                                                       | TP3     |   | Go to step 6.                                                       | Go to step 8.                                            |
| 6                                                                                       | U3-1    |  | Check transistor Q3 and associated components. Replace as required. | Check U3 and associated components. Replace as required. |
| 7                                                                                       | U1-4    |  | Check resistors R2, R3, and R4. Replace as required.                | Go to step 8.                                            |

Table 3-12. Functional Troubleshooting Chart,  
Out of Circuit Procedure - Continued

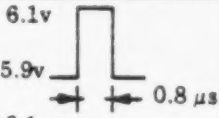
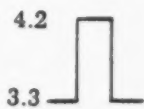
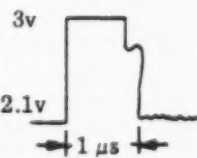
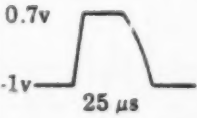
| CIRCUIT CARD: Detector and Video Amplifier (AR3)<br>(Part No. 4023409-0503) - Continued |         |                                                                                     |                                                   |                   |
|-----------------------------------------------------------------------------------------|---------|-------------------------------------------------------------------------------------|---------------------------------------------------|-------------------|
| STEP                                                                                    | MEASURE | SIGNAL                                                                              | ABNORMAL INDICATION                               | NORMAL INDICATION |
| FUNCTION/SYMP TOM: No Log Video Output                                                  |         | OPERATIONS: Mode 2, Code 0000<br>MASTER to STBY                                     |                                                   |                   |
| 8                                                                                       | U1-5    |    | Replace U1.                                       | Go to step 9.     |
|                                                                                         | U1-11   |    | Replace U1.                                       |                   |
| 9                                                                                       | U5-8    |   | Replace U5.                                       | Go to step 10.    |
| 10                                                                                      | J1      |  | Replace U5.                                       |                   |
| FUNCTION/SYMP TOM: No Anti-Jam                                                          |         | OPERATIONS: Mode 2, Code 0000<br>MASTER to STBY                                     |                                                   |                   |
| 1                                                                                       | U5-3    |  | Check resistors R20 and R22. Replace as required. | Go to step 2.     |



Table 3-12. Functional Troubleshooting Chart,  
Out of Circuit Procedure - Continued

| CIRCUIT CARD: Detector and Video Amplifier (AR3)<br>(Part No. 4023409-0503) - Continued |         |                                                                                                                  |                                                 |                                                                |
|-----------------------------------------------------------------------------------------|---------|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|----------------------------------------------------------------|
| STEP                                                                                    | MEASURE | SIGNAL                                                                                                           | ABNORMAL INDICATION                             | NORMAL INDICATION                                              |
| FUNCTION/SYMP TOM: No Anti-Jam                                                          |         |                                                                                                                  | OPERATIONS: Mode 2, Ccde 0000<br>MASTER to STBY |                                                                |
| 2                                                                                       | U5-5    | Train of ran-<br>dom pulses 0V<br>to 2.5V.<br>Ground (no<br>pulses during<br>time of sup-<br>pression<br>pulse). | Replace U5.                                     | Go to step 3.                                                  |
| 3                                                                                       | U4-7    | Same as<br>U5-5<br>0V to 2V                                                                                      | Check U4. Replace<br>if defective.              | Check resistor R21<br>and diode CR3. Re-<br>place as required. |

|                                                                     |           |            |                    |            |           |            |                    |
|---------------------------------------------------------------------|-----------|------------|--------------------|------------|-----------|------------|--------------------|
| CIRCUIT CARD: Delay Line (DL1)                                      |           |            |                    |            |           |            |                    |
| DELAY LINE (DL1)                                                    |           |            |                    |            |           |            |                    |
| Make the following resistance measurements with multimeter ME-26/U. |           |            |                    |            |           |            |                    |
| <u>PIN</u>                                                          | <u>to</u> | <u>PIN</u> | <u>MEASUREMENT</u> | <u>PIN</u> | <u>to</u> | <u>PIN</u> | <u>MEASUREMENT</u> |
| 1                                                                   |           | 4          | 16 $\Omega$        | 3          |           | 11         | 34 $\Omega$        |
| 1                                                                   |           | 6          | 10 $\Omega$        | 8          |           | 12         | 43 $\Omega$        |
| 1                                                                   |           | 7          | 4.7 $\Omega$       | 8          |           | 13         | 52 $\Omega$        |
| 1                                                                   |           | 3          | 8.0 $\Omega$       | 8          |           | 14         | 56 $\Omega$        |
| 8                                                                   |           | 22         | 160 $\Omega$       | 3          |           | 15         | 68 $\Omega$        |
| 8                                                                   |           | 9          | 15 $\Omega$        | 1          |           | 16         | 300 $\Omega$       |
| 8                                                                   |           | 10         | 25 $\Omega$        | 22         |           | 16         | 300 $\Omega$       |

Table 3-12. Functional Troubleshooting Chart,  
Out of Circuit Procedure - ContinuedPOWER SUPPLY (PS1)

The power supply (PS1) (part numbers 2073404-0704 and -705) is tested using the Tester-Dummy Load TS-3243/APM (or load bank assembly) and the procedures in paragraph 3-12. When problems are encountered, the troubleshooting procedures presented in this table should be used to find the cause of the problem. The circuitboard assemblies in the power supply are non-repairable and must be replaced as an assembly should a fault be traced to one of them.

WARNING

Lethal voltages are present when power is applied to test setup using tester (or load bank assembly). These voltages are present on red A1 wire, on terminal E5 of the tester, and on terminal A1 in the open power supply.

SYMPTOM

1. Power supply fails continuity test.

PROCEDURE

- a. Place the tester POWER switch at the OFF position.
- b. Disconnect tester connectors P1 and P2 from the power supply.
- c. Using the ME-26U multimeter, measure continuity (nominally zero ohm) between the following points of the power supply. A high resistance reading on any of these lines indicates a broken wire or faulty connection between the points referenced.

PS1P1 pin 1 to PS1P2 pin 1  
 PS1P1 pin 6 to PS1P2 pin 6  
 PS1P1 pin 10 to PS1P2 pin 10  
 PS1P1 pin 11 to PS1P2 pin 11  
 PS1P1 pin 12 to PS1P2 pin 2  
 PS1P1 pin 15 to PS1P2 pin 3  
 PS1P1 pin A2 to PS1P2 pin A2  
 PS1P1 pin 9 to ground (TP1 of power supply)

Table 3-12. Functional Troubleshooting Chart,  
Cut of Circuit Procedure - Continued

---

POWER SUPPLY (PS1)

---

| <u>SYMPTOM</u>                                     | <u>PROCEDURE</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Power supply fails continuity test - continued. | <p><u>d.</u> If continuity is obtained between each of the points indicated in the preceding step, connect the positive lead of the ME-26U multimeter to TP5 and the negative lead to TP1 (ground).</p> <p><u>e.</u> Reconnect P1 and P2 of the tester to the power supply.</p> <p><u>f.</u> Place the multimeter scale switch to a range sufficient to measure +12 vdc.</p> <p><u>g.</u> Place the POWER switch at the ON position.</p> <p><u>h.</u> If +12 vdc is present at TP5, the connection between pin 7 of PS1P1 and pin 1 of inductor L1 is open and must be repaired.</p> <p><u>i.</u> If no voltage is present at TP5, the problem is in subassembly 22375-2, 22653, or transformer T1 of the power supply.</p> |
| 2. Power supply fails to start.                    | <p><u>a.</u> Check for continuity between terminal 7 and collectors of transistors Q1 and Q2.</p> <p><u>b.</u> Check for presence of dc voltage at terminal 2 of transformer T3. If no dc voltage, check transistors Q1 and Q2 for open. If transistors Q1 and Q2 are good, replace regulator board 21431 or 21431-1 with replacement part 21431-1 and overcurrent assembly 21435 with 21435-1, if applicable.</p>                                                                                                                                                                                                                                                                                                          |

Table 3-12. Functional Troubleshooting Chart,  
Out of Circuit Procedure - Continued

---

POWER SUPPLY (PS1)

---

SYMPTOM

PROCEDURE

2. Power supply fails to start - continued.

c. If dc voltage is present at terminal 2 of transformer T3, and inverter does not start (this can be verified by checking for square waves at collectors of transistors Q15 and Q16), Q14 is probably open. Replace inverter drive assembly 21443 or 21443-1 with replacement part 21443-1 and overcurrent assembly 21435 with 21435-1, if applicable.

3. Power supply short circuit protection circuits trip under no-load conditions.

- a. Check to see if output voltages come up. If all voltages but one come up, remove assembly 21473 and isolate fault, using an ohmmeter. Replace appropriate subassembly 21447 or 21447-1, or 21451, or 21472, and overcurrent assembly 21435 with 21435-1, if applicable.
- b. Turn off power supply, remove wire from E11 of subassembly 21146 or 22146-1, and turn on power supply. If problem is solved, replace subassembly 22146 or 22146-1 with replacement part 22146-1 and overcurrent assembly 21435 with 21435-1, if applicable.

Table 3-12. Functional Troubleshooting Chart.

## Out of Circuit Procedure - Continued

## POWER SUPPLY (PS1)

SYMPTOMPROCEDURE

3. Power supply short circuit protection circuits trip under no-load conditions - continued.

c. If step 2b does not solve the problem, turn off power supply and reconnect wire to E11. Turn on power supply and check for presence of square waves at collector of transistors Q15 and Q16. If output of collector of either transistor Q15 or Q16 remain at ground, check for short and replace, if required. If transistors Q15 and Q16 are active when short occurs, transformer T2 is probably open. Replace inverter drive assembly 21443 or 21443-1 with replacement part 21443-1 and overcurrent assembly 21435 with 21435-1, if applicable.

d. If steps 2a through 2c do not locate fault, replace overcurrent assembly 21435 or 21435-1 if not replaced as part of above procedures.

4. Power supply will not regulate.

a. Check transistors Q1 and Q2 for short circuit. If defective, replace filter capacitor assembly 21494 and overcurrent assembly 21435 with 21435-1, if applicable.

b. Check for continuity between terminal 9 of subassembly 21435 or 21435-1 and point E9 of the -6 volt output. Repair wire or solder joint, if required.

Table 3-12. Functional Troubleshooting Chart

## Out of Circuit Procedure - Continued

## POWER SUPPLY (PS1)

SYMPTOMPROCEDURE

4. Power supply will not regulate - continued.

c. If no fault is found in steps 3a and 3b, replace regulator assembly 21431 or 21431-1 with 21431-1 and overcurrent assembly 21435 with 21435-1, if applicable.

5. Power supply fails to start (blows fuses)

a. Check to see if terminal 7 (PS1P1) is shorted to ground. If grounded, remove wires from junction of diodes CR1 and CR2, subassembly 22375-2. If problem is solved, replace subassembly 22375-2, and also replace overcurrent assembly 21435 with 21435-1, if applicable.

b. If terminal 7 (PS1P1) is still grounded after procedure of step 4a, the probable cause is a shorted capacitor in subassembly 21495 or a grounded collector on transistors Q1 or Q2. Replace subassembly 21495 or defective transistor. Replace overcurrent assembly 21435 with 21435-1, if applicable.

c. If condition occurs in ac only, check for shorted transformer (T1) primary or open in diodes CR1 or CR2 of subassembly 22375-2. Replace defective transformer or subassembly 22375-2. Replace overcurrent assembly 21435 with 21435-1, if applicable.

**3-14. Disassembly for Troubleshooting**

The RT-859A/APX-72 separates into two sections: The rf section and the digital and power supply section.

**CAUTION**

Remove the rf section slowly to avoid pulling the antenna lead from its connector.

- a. Unclamp and remove encircling flange coupler.
- b. Separate the rf assembly from the digital and power supply assembly.
- c. Disconnect subminiature coax connector from video output jack AR3J1 (fig. 3-5).
- d. Remove silicon O-ring from rf section.
- e. Set up AR3 for troubleshooting as follows:
  - (1) Perform disassembly procedures of paragraph a above.



- (2) Loosen cable connection (fig. 3-6).
- (3) Disconnect cable connection from preselcteor Z1 using a 1/4 inch open-end wrench.
- (4) Remove screws 1,2,3, and associated clamps.
- (5) Remove Z1.
- (6) Remove screws 9 and 12, and associated clamp.
- (7) Remove AR3 and connecting cable.
- (8) Replace Z1 and fasten with screw 2 and associated clamp (fig. 3-6).

- (9) Reconnect cable to Z1.
  - (10) Remove screw.
  - (11) Insert plastic shims between each side of cover and circuitboards of AR3 and remove cover (fig. 3-7).
  - (12) Place AR3 in position shown in figure 3-7 and tighten cable connection.
  - (13) Connect RT-859A/APX-72 into circuit shown in figure 3-1 and perform troubleshooting procedures of table 3-12, 1a and b.
- f. Replace AR3 after troubleshooting as follows:

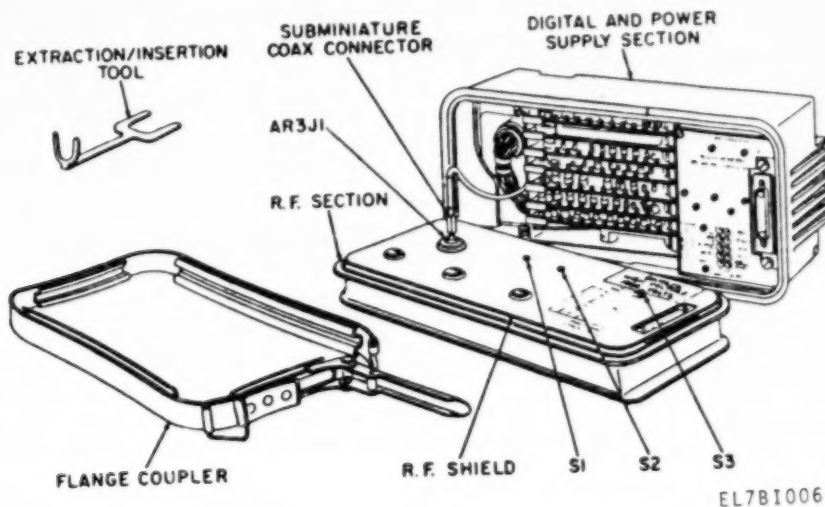
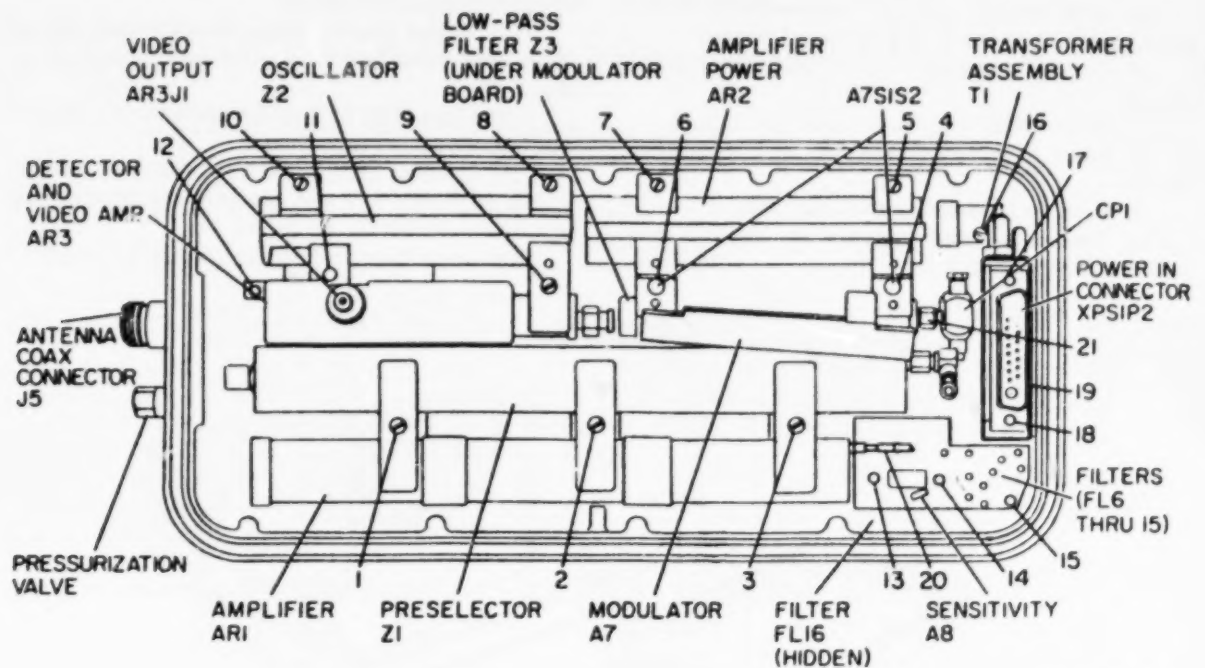
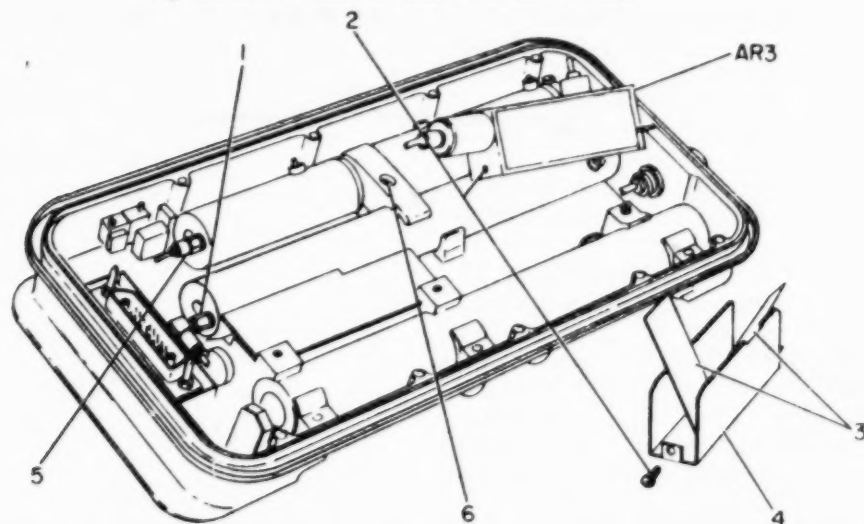


Figure 3-5. RT-859A/APX-72 Disassembly.



EL7BI009

Figure 3-6. RT-859A/APX-72 Rf Section Subassembly.



EL7BI008

Figure 3-7. Detector and Video Amplifier AR3 Disassembly.

- (1) Remove RT-859A/APX-72 from test set up.
- (2) Loosen cable connection.
- (3) Place plastic shims over circuit boards of AR3 and slide cover into place.
- (4) Remove plastic shims and secure cover with screw.
- (5) Disconnect cable from Z1.
- (6) Remove screws and associated clamps and remove Z1.
- (7) Replace AR3 and connecting cable securing with screws and associated clamps.
- (8) Apply a thin coat of heat conducting compound to Z1 and replace with screws (1, 2, 3, (fig. 3-7).
- (9) Reconnect cable connection (21, fig. 3-7) to Z1.
- (10) Tighten cable connection (20, fig. 3-7).

### 3-15. Troubleshooting Procedures for DL1.

- a. Remove DK1 by performing procedures of paragraph 3-14 a through d.
- b. Place DK1 in an suitable jig or holder to prevent damage to circuitboard and make resistance measurements as described in table 3-12 to determine serviceability. Replace DK1 by inserting circuitboard into card cage connector XDLIPI, identified by red color coding.

### 3-16. Troubleshooting Procedures for PS1.

- a. Remove PS1 from digital and power supply section.
- b. Use a Tester-Dummy Load TS-3243/APM to set up PS1 for troubleshooting as follows:
  - (1) Make sure that TS-2343/APM Power and reserve load switches are off. Connect TS-3243/APM power plug to 107-122 vac,  $400 \pm 20$  cps power source. Verify that POWER indicator is not lit.
  - (2) Connect P1 and P2 of TS-3243/APM to

PS1P1 and PS1P2, respectively.

#### WARNING

Lethal voltages are present in tester and PS1 when primary power is applied. Caution is necessary.

- (3) Place tester POWER switch to ON. Verify that POWER and CONTINUITY indicators are lit. This indicates proper operation of transformer T1, RF1 filter FL1, and rectifiers CR1 and CR2 in PS1. Also, all signal and control lines in PS1 are good.

(4) Perform steps 2 through 10 of table 3-5 to ensure that PS1 minimum performance standards are met.

- (5) Connect differential voltmeter between TP1 (+) and TP2 of tester and measure 310, +16, -6 vdc. Adjust R-63 as required.

(6) Place tester POWER switch to OFF and disconnect P1 and P2 of tester from PS1P1 and PS1P2, respectively.

- (7) Reconnect P1 and P2 of tester to PS1P1 and PS1P2 and perform troubleshooting procedures of table 3-12.

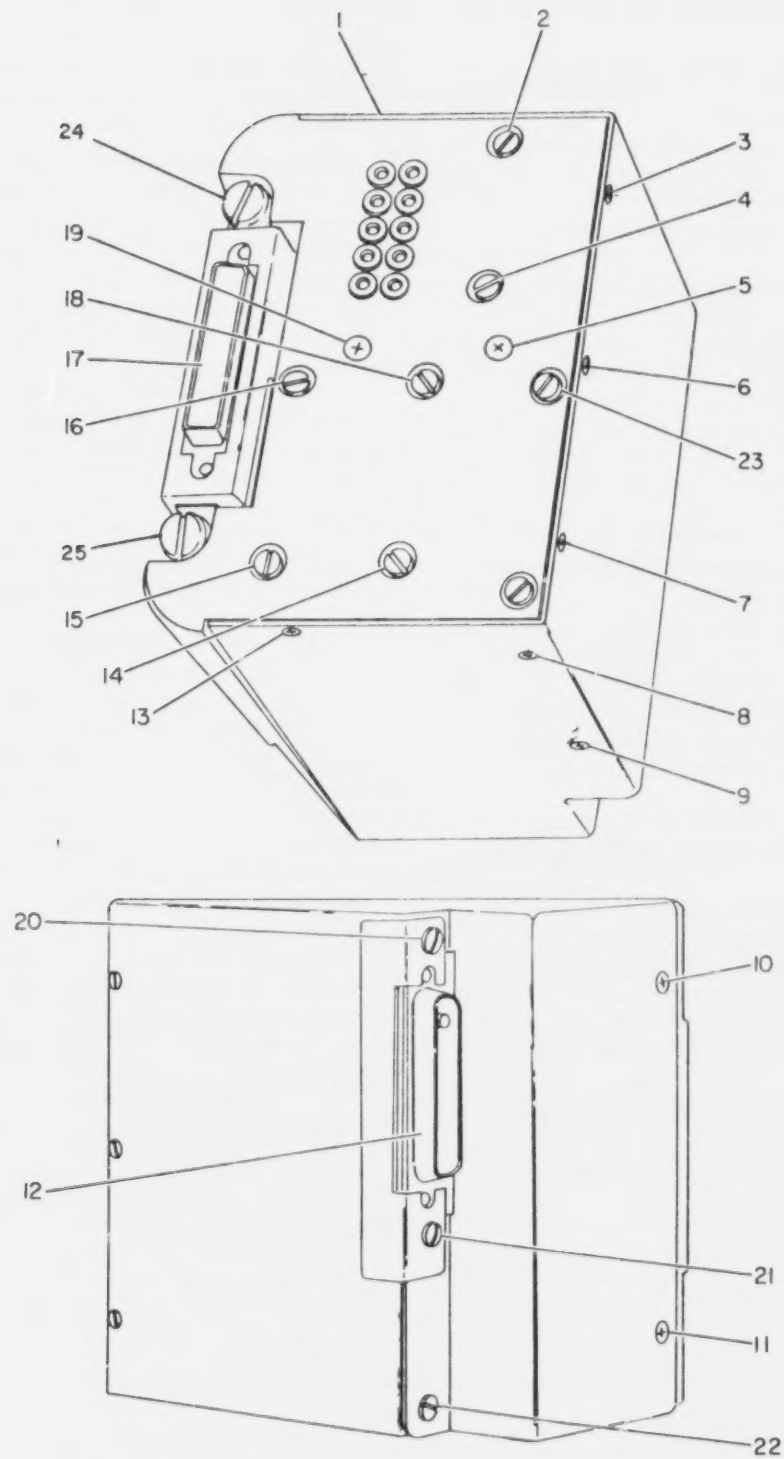
c. Should the TS-2343/APM tester-dummy load not be available for maintenance of PS1, the load bank described in paragraph 2-3 may be used along with the following procedures:

- (1) Set up PS1 for voltage measurements by separating RT-859A/APX-72 assemblies as described in paragraph 3-14 and shown in figure 3-5. Measure voltages as described in table 3-5 to ensure minimum performance standards are met.

- (2) Set C-6290(P)/APX (APM-239A) MASTER TO OFF.

- (3) Disconnect power cable from PS1P2 and XPS1P2 in troubleshooting setup of figure 3-6.

- (4) Loosen two slotted lift-out screws (24 and 25 fig. 3-8) and remove PS1 from digital and power supply section.



EL7BI007

Figure 3-8. Power Supply Cover Removal.

(5) Remove 12 screws (1, 3, 6 thru 11, 13, 20, 21, and 22 figure 3-8) and remove cover and clamps from PS1.

(6) Connect load bank to PS1P2, using power cable disconnected in step (6) above.

(7) Connect load bank ground to PS1TP1 ground.

(8) Connect cable assembly, power supply test between PS1P1 and XPS1P1.

### WARNING

Lethal voltages are present in PS1 and load bank when primary power is applied. These voltages are present on A1 of P2 in load bank and the associated resistors, wiring, and on terminal A1 of the open power supply.

(9) Connect differential voltmeter between TPI (+) and TP2 of tester and measure 310, +16, 6 vdc. Adjust R-63 as required.

(10) Place tester POWER switch to OFF and disconnect P1 and P2 of tester from PS1P1 and PS1P2, respectively.

(11) Reconnect P1 and P2 of tester to PS1P1 and PS1P2 and perform troubleshooting procedures of table 3-12.

## 3-17. Alinement and Adjustment Procedures, Transponder Test Set AN/APM-305A

a. Alinement and adjustment procedures are performed to obtain optimum results from the receiver-transmitter. These procedures are followed, when necessary, in conjunction with the performance tests and measurements (para 3-7 through 3-10) and during repair or replacement of individual subassemblies. Test equipment, used for alinement procedures, is listed in paragraph 2-2. Test points, adjustments, and waveform figure references are listed in table 4-24, TM 11-5895-490-35, and their locations in figure 4-13, TM 11-5895-490-35.

b. Perform the preliminary procedures as described below and as shown in figure 3-9.

### CAUTION

Ensure that C-6280(P)/APX MASTER switch is set to STBY while performing these procedures.

(1) *Receiver-transmitter.*

(a) Depressurize and remove flange coupler.

(b) Separate digital and power supply section from rf section removing O-ring and rf shield (4-19 and 4-20a and b, TM 11-5895-490-35).

(c) Connect both sections together, side by side, using a typical jig which could consist of two flange couplers welded together (fig. 4-5 and 4-37, TM 11-5895-490-35).

(d) Connect power supply jumper cable (fig. 4-11, TM 11-5895-490-35) between XPS1P2 and XPS1J2.

(e) Connect rf connector and cable assembly (part number 4023657, fig. 4-11, TM 11-5895-490-35) between AR3J1 and P3.

(f) Connect a jumper cable between E9 and PS1TP4 (+6 vdc).

(g) Connect POWER, CONTROL and VIDEO J1 to TRANSPONDER power and control on AN/APM-239.

(h) Connect a cable between ANT. J5 and MAIN RF IN/OUT on AN/APM-305A.

(i) Connect probe from A INPUT on AN/USM-281A to AR3TP1.

(2) *Test Set, Transponder AN/APM-239A.*

(a) Connect PWR INPUT to 115-vac, 400-Hertz voltage source.

(b) Ensure TRANSPONDER power and control is connected to POWER CONTROL and VIDEO J1 on receiver-transmitter.

(c) Set all controls and switches as directed in table 3-3.

(3) *Oscilloscope AN/USM-281A.*

(a) Connect power cord to 115-vac, 60-Hertz voltage source.

(b) Ensure that EXT INPUT is connected to SCOPE TRIG OUT on AN/APM-305A.

(c) Ensure that B INPUT is connected to MKRS OUT AN/APM-305A.

(d) Ensure that A INPUT is connected through probe to AR3TP1.

(e) Set DISPLAY to ALT.

(f) Set POWER to ON and adjust controls and switches for display presentation.

(4) *Transponder Test Set AN/APM-305A.*

(a) Connect power cord to 115-vac, 60-Hz voltage source.

(b) Ensure that MAIN RF IN/OUT is connected to ANT. J5 on receiver-transmitter.

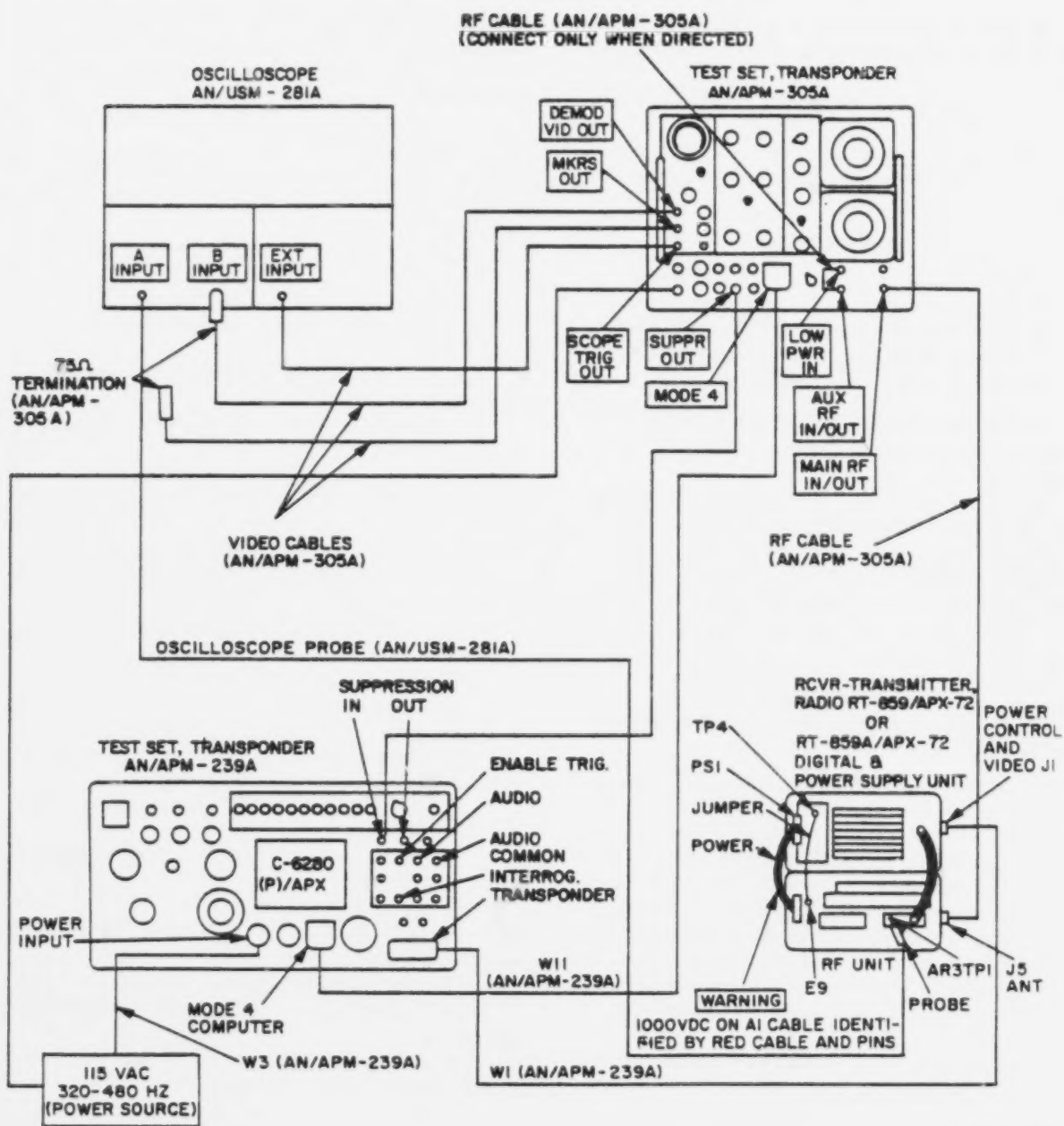
(c) Ensure that MODE 4 is connected to MODE 4 COMPUTER on AN/APM-239A.

(d) Ensure that SUPPRESSION OUT is connected to SUPPRESSION IN on AN/APM-239A.

(e) Ensure that SCOPE TRIG OUT is connected to EXT INPUT on AN/USM-281A.

(f) Set switches and controls as listed in table 3-2.

c. To perform the complete alinement of the receiver-transmitter, follow the instructions given in table 3-13.



EL7B1015

Figure 3-9. Receiver Alinement Test Setup using AN/UPM-305A.



Table 3-13. Complete Alinement and Adjustment Procedures Using AN/APM-305A

| STEP                   | PROCEDURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | REMARKS                                                                                                                                                                                                                                                    |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Receiver alinement. | <p>a. Set AN/USM-281A MAIN TIME/DIV to .2 MSEC, sweep display (red knob) to MAIN. Set AN/APM-305A SIG GEN FUNCTION to SWP <math>\pm 20</math> MHZ, CHAL MODE SELECT to CW, MEASUREMENT FUNCTION SELECT to FREQ, MAIN ATTEN to -33 dB.</p> <p style="text-align: center;"><b>WARNING</b></p> <p>Terminals adjacent to receiver tuning adjustments are at voltage levels hazardous to life.</p> <p>b. Loosen locknuts on preselector adjustment Z1C1 and rf amplifier AR1C3.</p> <p>c. Adjust Z1C1 for peak response at 1030 MHz. Normally Z1C2, Z1C3, AR1C1, and AR1C2 do not require adjustment. Should adjustment of Z1C1 not provide peak response at 1030 MHz, loosen locknuts and adjust Z1C2, Z1C3, AR1C1, AR1C2, and AR1C3 in given order for peak response at 1030 MHz.</p> <p>d. Set AN/APM-305A MAIN ATTEN first for 0.3-volt peak-to-peak waveform amplitude, and then to nearest whole-dB mark. Set AN/USM-281A A VOLTS/DIV to .01 (10:1 probe) or .1 (1:1 probe), and use A POSITION and B POSITION to aline peak of A INPUT waveform with baseline of B INPUT waveform below center horizontal graticule. Decrease AN/APM-305A MAIN ATTEN by 6 dB. A INPUT waveform now crosses B INPUT baseline at the 6-dB points.</p> <p>e. Adjust A1C1 and AR1C3 alternately for the best obtainable waveform about 1030 MHz. Obtain best compromise between peak response and waveform symmetry.</p> <p>f. Repeat step e above and note bandwidth (using markers), which should be at least <math>\pm 3.5</math> MHz between 6-dB points. If not, repeat d and e as necessary. When bandwidth of <math>\pm 3.5</math> MHz is achieved, tighten both adjustment locknuts, using care to prevent change in tuning adjustments.</p> <p>g. Disconnect probe from A INPUT of AN/USM-281A, and disconnect cable with termination from B INPUT. Connect A INPUT to AN/APM-305A MEASUREMENT MKRS OUT, and connect B INPUT to AN/APM-305A MEASUREMENT DEMOD VID OUT with corresponding cables and terminations. Set AN/APM-305A CHAL MODE SELECT to 2.</p> <p>h. Measure frequency and bandwidth for minimum</p> | <p>Compare bandwidth on A INPUT of AN/USM-281A with center-frequency (1030-MHz) marker on B INPUT.</p> <p>Monitor waveform on AN/USM-281A.</p> <p>Observe waveform for <math>\pm 3.5</math>-MHz bandwidth at 6-dB points.</p> <p>Performance standard:</p> |

Table 3-13. Complete Alinement and Adjustment Procedures Using AN/APM-305A—continued

| STEP                                                                                 | PROCEDURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | REMARKS                                                                                   |
|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
|                                                                                      | performance standards using procedures of paragraph 3-2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Center frequency<br>1030 $\pm$ 1.5 MHz and<br>6-dB bandwidth 7 MHz,<br>minimum.           |
| 2. Voltage level adjustments (For AR3 part Nos. 4023409-0501 and 4023409-0502 only). | <ol style="list-style-type: none"> <li>i. Disconnect cable with termination from A INPUT of AN/USM-281A, and reconnect probe to A INPUT. Set AN/APM-305A SIG GEN FUNCTION to FIXED FREQ.</li> <li>a. Use differential voltmeter MIL-V-9989 for this step. Set C-6280(P)/APX (AN/APM-239A) MASTER to STBY.</li> <li>b. Connect positive lead of differential voltmeter to ground and negative lead to AR3TP3. Adjust AR3R76 for voltage reading of -4.5 vdc. Disconnect leads.</li> <li>c. Connect negative lead of differential voltmeter to ground and positive lead to AR3TP2. Adjust AR3R73 for voltage reading of 4.5 vdc. Disconnect leads.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <p>Read -4.5 <math>\pm</math> 0.025 vdc.</p> <p>Read +4.5 <math>\pm</math> 0.025 vdc.</p> |
| 3. Normal sensitivity adjustments.                                                   | <ol style="list-style-type: none"> <li>a. Set AN/APM-305A MEASUREMENT FUNCTION SELECT to PRF CHAL, MEASUREMENT PRF RANGE SELECT to PRF CHAL, MEASUREMENT PRF RANGE and PRF SELECT RANGE both to X100. meter reading of 500 Hz.</li> <li>b. Set AN/APM-305A CHAL MODE SELECT to 2, and set MAIN ATTEN for a signal level of -77.5 dBm (-90.5 dBV) at ANT. J5 or receiver-transmitter, allowing for 1030-MHz loss in rf cable connected to ANT. J5. This level is MTL to be established.</li> <li>c. Set C-6280(P)/APX (AN/APM-239A) MASTER to STBY.</li> <li>d. Set AN/USM-281A MAIN TIME/DIV to 1 <math>\mu</math>SEC, sweep display to MAIN, and connect probe (A INPUT) to A1TP6 of receiver-transmitter. Set AN/APM-305A SCOPE TRIG/FREQ MEAS DELAY (USEC) RANGE to X4, MULT to 5.3. Observe interrogation pulses (P1 and P3) at A1TP6, and adjust A8R6 for a pulse amplitude of 0.7 <math>\pm</math> 0.1 volt. Measure from the center of baseline noise to center of peak pulse noise. Verify that the largest negative going noise peaks during each pulse are at least 0.2 volt more positive than the largest positive noise peaks on the baseline. Remove the probe from A1TP6.</li> <li>e. Set AN/305A CHAL MODE SELECT to CW, MAIN ATTEN for a signal level of -47 dBm at ANT. J5 of receiver-transmitter.</li> <li>f. Set AN/USM-281A MAIN TIME/DIV to .1 MSEC, and connect probe to A1TP2. Random pulses triggered by noise may or may not appear. Adjust A1R22 counterclockwise until no random pulses</li> </ol> |                                                                                           |

Table 3-13. Complete Alinement and Adjustment Procedures Using AN/APM-305A—continued

| STEP                                                       | PROCEDURE                                                                                                                                                                                                                                                                                         | REMARKS                                             |
|------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
|                                                            | are present, then slowly clockwise until random pulses begin to appear. Adjust A1R22 an additional 1/4-turn clockwise. Remove probe from A1TP2.                                                                                                                                                   |                                                     |
|                                                            | g. Connect AN/USM-281A probe to A1TP5. Random pulses triggered by noise may or may not appear. Adjust A1R25 clockwise until random pulses appear, then slowly counterclockwise until no random pulses are present. Adjust A1R25 an additional 1/4 turn counterclockwise. Remove probe from A1TP5. | MTL - 77.5 dBm at ANT. J5.                          |
|                                                            | h. Set AN/APM-305A CHAL MODE SELECT to 2, MAIN ATTEN for a signal level of -77.5 dBm at ANT. J5 of receiver-transmitter.                                                                                                                                                                          |                                                     |
|                                                            | i. Set C-6280(P)/APX (AN/APM-239A) MASTER to NORM.                                                                                                                                                                                                                                                |                                                     |
|                                                            | j. Set AN/APM-305A MEASUREMENT FUNCTION SELECT to PRF REPLY. Observe MEASUREMENT meter, and adjust A8R6 slowly counterclockwise until the MEASUREMENT meter indicates an average count of 450 Hz. Note AN/APM-305A MAIN ATTEN setting for MTL reference in subsequent steps.                      |                                                     |
| 4. Ditch length adjustments. (RT-859/APX-72 only.)         | a. Set C-6280(P)/APX (AN/APM-239A) MASTER to STBY.                                                                                                                                                                                                                                                |                                                     |
|                                                            | b. Set AN/USM-281A MAIN TIME/DIV to 2 $\mu$ SEC, and connect probe to A1TP4.                                                                                                                                                                                                                      |                                                     |
|                                                            | c. Set AN/APM-305A MAIN ATTEN for a signal level of -27 dBm (-40 dBV) at ANT. J5 of receiver-transmitter. Set AN/APM-305A CHAL MODE SELECT to C. Ensure that the SCOPE TRIG/FREQ MEAS DELAY (USEC) RANGE is set to X4, and set MULT to 1.2.                                                       |                                                     |
|                                                            | d. Adjust A1R10 to obtain a trapezoidal pulse width at baseline equal to 13.5 $\mu$ s. Remove probe from A1TP4.                                                                                                                                                                                   | Waveform at A1TP4 in figure 6-4, TM 11-5895-490-35. |
| 5. Wide pulse detector adjustments. (RT-859A/APX-72 only.) | a. Ensure that the C-6280(P) (AN/APM-239A) MASTER is set to NORM.                                                                                                                                                                                                                                 |                                                     |
|                                                            | b. Remove termination from AN/APM-305A LOW POWER IN, and connect rf cable from AUX RF IN/OUT to LOW POWER IN. Set AUX ATTEN to minimum (fully clockwise), MEASUREMENT DEMOD VID LEVEL approximately 3/4-turn clockwise.                                                                           |                                                     |
|                                                            | c. Set AN/APM-305A MAIN ATTEN for a signal level of 3 dB above MTL (3j above) at ANT. J5 of receiver-transmitter. Set AN/APM-305A CHAL MODE SELECT to C. Ensure that the SCOPE TRIG/FREQ MEAS DELAY (USEC) RANGE is set to X4, and set MULT to 1.2.                                               |                                                     |
|                                                            | d. Observe first interrogation pulse on B INPUT of                                                                                                                                                                                                                                                |                                                     |

Table 3-13. Complete Alinement and Adjustment Procedures Using AN/APM-305A—continued

| STEP                                  | PROCEDURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | REMARKS |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| 6. Side-lobe suppression adjustments. | AN/USM-281A. Set AN/APM-305A MEASUREMENT DEMOD VID LEVEL for a pulse amplitude of 2 volts. Set CHAL WIDTH SELECT (outer) to VARY and set VARY (inner) for a pulse width of 1.4 $\mu$ s at 50% amplitude points. Increase AN/APM-305A SCOPE TRIG/FREQ MEAS DELAY (USEC) MULT to observe second interrogation pulse (P3) for same pulse width.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |         |
|                                       | <ol style="list-style-type: none"> <li>e. Disconnect cable from AN/APM-305A LOW POWER IN, and reconnect termination to LOW POWER IN.</li> <li>f. Observe AN/APM-305A MEASUREMENT meter, and adjust A1R10 counterclockwise for an average count higher than 100 Hz, then clockwise for an average count of 10 Hz. Set AN/APM-305A MEASUREMENT PRF RANGE to X10 as count decreases. Rotate AN/APM-305A MAIN ATTEN from 3 dB to 50 dB above MTL. If MEASUREMENT meter indicates an average count higher than 10 Hz, readjust A1R10. Set AN/APM-305A MEASUREMENT PRF RANGE to X100.</li> <li>a. Set C-6280(P)/APX (AN/APM-239A) MASTER to STBY. Connect AN/USM-281A probe to A1TP6, and set MAIN TIME/DIV to 5 <math>\mu</math>SEC.</li> <li>b. Ensure that the AN/APM-305A CHAL MODE SELECT is set to C, and set CHAL WIDTH SELECT to 0.80. Ensure SCOPE TRIG/FREQ MEAS DELAY (USEC) RANGE is set to X4, and set MULT to 1.0 (fully counterclockwise). Set MAIN ATTEN for a signal level of ANT. J5 of 6 dB above MTL (step 3j above). Ensure that the CHAL ISLS SPACING SELECT is set to 0, and set CHAL INHIBIT to ISLS ON.</li> <li>c. Note peak amplitude of first interrogation pulse (reference level) on A INPUT of AN/USM-281A. Decrease AN/APM-305A MAIN ATTEN by 6 dB. Adjust AUX ATTEN (ISLS scale) for an ISLS pulse amplitude equal to the reference level noted above. This sets ISLS pulse level 6 dB below interrogation pulse level. Remove probe from A1TP5.</li> <li>d. Adjust MAIN ATTEN for a signal level of -64 dBm at ANT. J5. Connect AN/USM-281A probe at A1TP2. Adjust A1R6 until ISLS pulse appear intermittently at A1TP2, then readjust until ISLS pulse just disappears. Rotate MAIN ATTEN from MTL plus 3 dB to MTL plus 50 dB. If ISLS pulse reappears intermittently from 6 to 50 dBV above MTL, repeat adjustments until ISLS pulse does not reappear in this range. Disconnect probe from A1TP2.</li> </ol> |         |

Table 3-13. Complete Alinement and Adjustment Procedures Using AN/APM-305A—continued

| STEP                                    | PROCEDURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | REMARKS      |
|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 7. Low sensitivity adjustments.         | <p>e. Set AN/APM-305A CHAL INHIBIT to OFF, CHAL MODE SELECT to 2. Set MAIN ATTEN for MTL at ANT. J5. Set C-6280(P)/APX (AN/APM-239A) MASTER to NORM. Adjust A8R6 until AN/APM-305A MEASUREMENT meter indicates an average count of 450 Hz.</p> <p>f. Set C-6280(P)/APX MASTER to STBY. Repeat 6b and d above, and adjust A1R6 only if required. If A1R6 requires adjustment, repeat 6e above, adjusting A8R6 only if required.</p> <p>g. If A8R6 requires adjustment set AN/APM-305A CHAL INHIBIT to OFF and repeat procedures of steps 3 and 5 above, then 6a through 6f above, until no further adjustments are required.</p>                                                                                 | 90% replies. |
|                                         | <p>a. Ensure that the AN/APM-305A CHAL INHIBIT is set to OFF and CHAL MODE SELECT is set to 2. Set MAIN ATTEN for a signal level of -65 dBm at ANT. J5 (receiver-transmitter). Set C-6280(P)/APX (AN/APM-239) MASTER to LOW.</p> <p>b. Adjust A8R5 until AN/APM-305A MEASUREMENT meter indicates an average count of 450 Hz. Set C-6280(P)/APX MASTER to NORM.</p>                                                                                                                                                                                                                                                                                                                                              |              |
|                                         | <p>a. Ensure AN/APM-305 MEASUREMENT FUNCTION SELECT to PRF REPLY, and set PRF SELECT MULT to 2.2. Then set MEASUREMENT PRF RANGE and PRF SELECT RANGE both to X1K.</p> <p>b. Ensure C-6280(P)/APX (AN/APM-239A) MASTER is set to NORM.</p> <p>c. Set AN/APM-305A MAIN ATTEN for a signal level of -71 dBm at ANT. J5 of receiver-transmitter.</p> <p>d. Observe an AN/APM-305A MEASUREMENT meter and adjust A2R89 clockwise until MEASUREMENT meter indicates an average count of approximately 2000 Hz. Slowly increase AN/APM-305A PRF SELECT MULT to 3.0, and if MEASUREMENT meter indication increases, adjust A2R89 counterclockwise until meter indication stops increasing at approximately 2000 Hz.</p> |              |
| 8. Reply rate limiter adjustments.      | <p>a. Set AN/APM-305A MEASUREMENT FUNCTION SELECT to PRF CHAL. Observe MEASUREMENT meter, and set PRF SELECT MULT for a reading of 1800 Hz. Ensure that the C-6280(P)/APX (AN/APM-239A) MASTER is set to NORM.</p> <p>b. Disconnect AN/USM-281A probe from A INPUT. Disconnect cable from AN/APM-305A MEASUREMENT MKRS OUT, and connect cable and termination between MEASUREMENT TIMING</p>                                                                                                                                                                                                                                                                                                                    |              |
| 9. Transmitter pulse width adjustments. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |



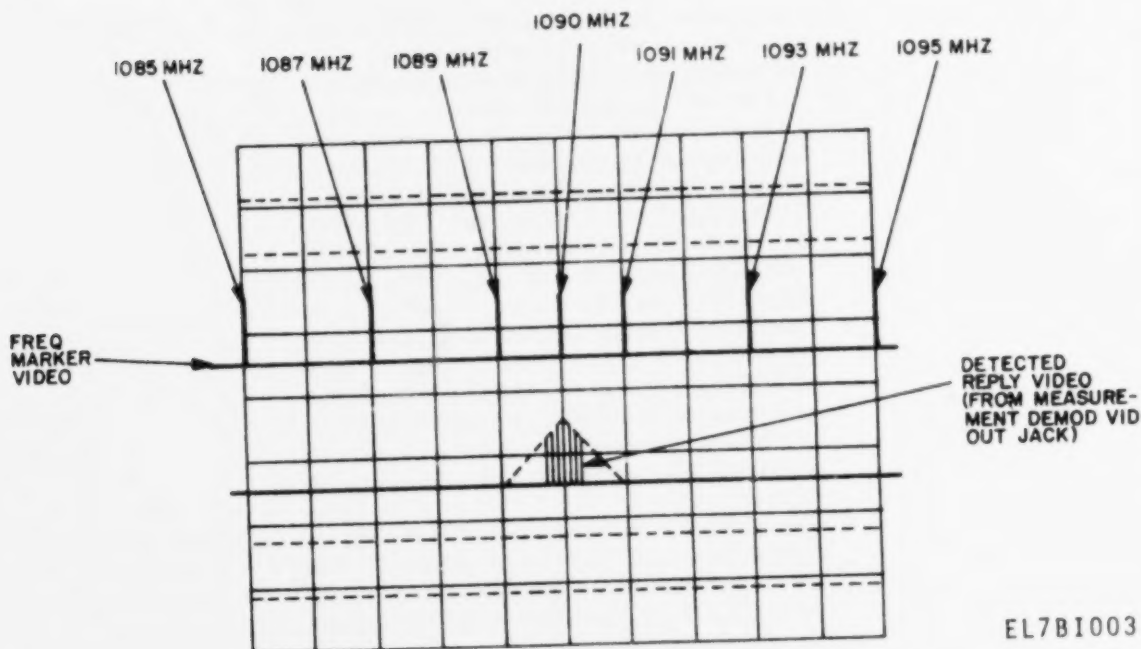
Table 3-13. Complete Alinement and Adjustment Procedures Using AN/APM-305A—continued

| STEP                                                               | PROCEDURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | REMARKS                                                                                                                         |
|--------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
|                                                                    | <p>MKRS OUT and A INPUT of AN/USM-281A.</p> <p>c. Set AN/APM-305A SCOPE TRIG/FREQ MEAS DELAY (USEC) MULT to 7.0. Set AN/USM-281A MAIN TIME/DIV to 5 <math>\mu</math>SEC and observe <math>F_1</math> and <math>F_2</math> reply pulses (B INPUT) with 10-, 1.0-, and 0.1-<math>\mu</math>s markers (A INPUT). Set AN/USM-281A HORIZONTAL MAGNIFIER to X10 and vary HORIZONTAL POSITION to observe the pulse width of each reply pulse. Adjust A7R4 for a reply pulse width of <math>0.45 \pm 0.1 \mu</math>s at 50% amplitude points.</p> <p>d. Set AN/USM-281A HORIZONTAL MAGNIFIER to X1, HORIZONTAL POSITION to center the display.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                 |
| 10. Duty cycle control adjustments.                                | <p>a. Observe AN/APM-305 MEASUREMENT meter, and set PRF SELECT MULT for a reading of 1700 Hz. Set MODE 2 code (receiver-transmitter) to 7777.</p> <p>b. Set AN/APM-305A MEASUREMENT FUNCTION SELECT to PRF REPLY. Observe MEASUREMENT meter, and adjust A2R51 for an average count of 1625 Hz.</p> <p>c. Adjust A2R89 for an average count of 1200 Hz.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                 |
| 11. Reply pulse spacing adjustments.<br>(RT-859A/<br>APX-72 only). | <p>a. Set MODE 2 code (receiver-transmitter) to 0000. Set AN/APM-305A MEASUREMENT FUNCTION SELECT to PRF CHAL, MEASUREMENT PRF RANGE and PRF SELECT RANGE both to X100. Set PRF SELECT MULT for a MEASUREMENT meter reading of 500 Hz.</p> <p>b. Compare <math>F_1</math> and <math>F_2</math> reply pulses on B INPUT of AN/USM-281A with 10-, 1.0-, and 0.1-<math>\mu</math>s markers on A INPUT. Set HORIZONTAL multiplier to X10, and vary HORIZONTAL POSITION to measure spacing between leading edges (50% amplitude points) of <math>F_1</math> and <math>F_2</math>, using the markers. Adjust A4C1 so that the spacing between leading edges of <math>F_1</math> and <math>F_2</math> is <math>20.3 \pm 0.05 \mu</math>s.</p> <p>c. Set MODE 2 code to 0007. Spacing between leading edges of <math>F_1</math> and <math>F_2</math> should remain <math>20.3 \pm 0.05 \mu</math>s. If not, readjust A4C1, set MODE 2 code to 0000, and repeat b above and this step until tolerance is met with and without code pulses.</p> <p>d. Set AN/USM-281A HORIZONTAL MULTIPLIER to X1, HORIZONTAL POSITION to center the display. Remove cable from AN/APM-305A MEASUREMENT TIMING MKRS OUT, and reconnect to MEASUREMENT MKRS OUT.</p> | <p>Frame pulse spacing<br/><math>20.3 \pm 0.05 \mu</math>s.</p> <p>Frame pulse spacing<br/><math>20.3 \pm 0.05 \mu</math>s.</p> |
| 12. Transmitter frequency and power adjustments.                   | <p>a. Ensure that the C-6280(P)/APX (AN/APM-239A) MASTER is set to NORM. Set MODE 2 code (receiver-transmitter) to 7777. Ensure that the AN/APM-305A PRF SELECT RANGE and MULT are</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                 |



Table 3-13. Complete Alinement and Adjustment Procedures Using AN/APM-305A—continued

| STEP | PROCEDURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | REMARKS |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
|      | <p>set for a MEASUREMENT meter reading of 500 Hz with MEASUREMENT FUNCTION SELECT at PRF CHAL. Decrease MAIN ATTEN, if necessary, until reply pulses appear on B INPUT of AN/USM-281A.</p> <p>b. Connect AN/USM-281A A INPUT to MEASUREMENT MKRS OUT on AN/APM-305A. Set AN/APM-305A SIG GEN FUNCTION to SWP <math>\pm 20</math> MHz, MEASUREMENT FUNCTION SELECT to FREQ.</p> <p>c. Set AN/USM-281A MAIN TIME/DIV to .2 MSEC, DELAYED TIME/DIV to 20 <math>\mu</math>SEC, sweep display (red knob) to DELAYED. Set DIV DELAY to aline the center frequency (1090 MHz) marker on center vertical graticule.</p> <p>d. Set AN/APM-305A SCOPE TRIG/FREQ MEAS DELAY (USEC) RANGE to X400, use MULT to aline reply pulses on B INPUT of AN/USM-281A to 1090 MHz (center graticule). Adjust Z2C1 (receiver-transmitter) for maximum pulse amplitude at 1090 MHz (fig. 3-10). Vary MULT to verify that all reply pulses reach peak amplitude at <math>1090 \pm 3</math> MHz.</p> |         |



EL7BI003

Figure 3-10. Receiver-Transmitter (1090 MHz) Measurements.

Table 3-13. Complete Alinement and Adjustment Procedures Using AN/APM-305A—continued

| STEP                                                       | PROCEDURE                                                                                                                                                                                                                                                                                                                                                               | REMARKS                                                                                |
|------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| 13. Mode 4 gate adjustments.<br>(RT-859A/<br>APX-72 only.) | e. Set AN/APM-305A SCOPE TRIG/FREQ MEAS DELAY (USEC) RANGE to X4 and MULT to 7.0; SIG GEN FUNCTION to FIXED FREQ, MEASUREMENT FUNCTION SELECT to PWR. Set AN/USM-281A MAIN TIME/DIV to 5 USEC, sweep display to MAIN.                                                                                                                                                   | 27 dBW $\pm$ 3 dBW (and equal to $F_1 \pm 1$ dB)                                       |
|                                                            | f. Observe reply pulses on B INPUT of AN/USM-281A, and adjust AR2C1 for maximum pulse amplitude.                                                                                                                                                                                                                                                                        |                                                                                        |
|                                                            | g. Repeat 12b, c, and d above to readjust Z2C1, if necessary, for a transmitter frequency of $1090 \pm 3$ MHz. Then repeat 12e above.                                                                                                                                                                                                                                   |                                                                                        |
|                                                            | h. Observe $F_1$ reply pulse on B INPUT of AN/USM-281A, and set AN/APM-305A MEASUREMENT DEMOD V/D LEVEL for a pulse amplitude of 1.0 volt. Read MEASUREMENT meter dBW scale, and calculate $F_1$ pulse power by adding 1090-MHz loss of rf cable connected to ANT. J5.                                                                                                  |                                                                                        |
|                                                            | i. Repeat 12h above for $F_2$ pulse power.                                                                                                                                                                                                                                                                                                                              |                                                                                        |
|                                                            | a. Set C-6280(P)/APX (AN/APM-239A) MASTER to OFF. For access to adjustments on mode 4 circuit board A3, remove A3 from receiver-transmitter, and reinstall in the appropriate AN/APM-239A extender board (A3) in accordance with paragraph 4-16a, figure 4-14, and table 4-29, TM 11-5895-490-35. Then set C-6280(P)/APX MASTER to STBY for 1 minute before proceeding. |                                                                                        |
|                                                            | b. Set C-6280(P)/APX (AN/APM-239A) MASTER to NORM, MODE 4 to ON.                                                                                                                                                                                                                                                                                                        |                                                                                        |
|                                                            | c. Ensure AN/APM-305A PRF SELECT RANGE and MULT are set for a MEASUREMENT meter reading of 500 Hz with MEASUREMENT FUNCTION SELECT at PRF CHAL. Set CHAL MODE SELECT to 4A, CHAL WIDTH to 0.50, SCOPE TRIG/FREQ MEAS DELAY (USEC) RANGE TO X4, and MULT to 2.3.                                                                                                         |                                                                                        |
|                                                            | d. Set AN/APM-305A MEASUREMENT FUNCTION SELECT to PRF REPLY. Increase MAIN ATTEN until MEASUREMENT meter indicates an average count of 400 Hz, then decrease MAIN ATTEN to obtain an average count of 450 Hz. MAIN ATTEN setting represents mode 4 MTL. Decrease setting by 3 dB.                                                                                       |                                                                                        |
|                                                            | e. Disconnect cable from AN/APM-305A MEASUREMENT MKRS OUT, and connect to AN/APM-239A MODE 4 ENABLE TRIG. Set AN/USM-281A MAIN TIME/DIV to .5 USEC, and observe mode 4 trigger pulse characteristics on A INPUT.                                                                                                                                                        |                                                                                        |
|                                                            | f. Disconnect cable with termination from A IN-                                                                                                                                                                                                                                                                                                                         |                                                                                        |
|                                                            |                                                                                                                                                                                                                                                                                                                                                                         | Trigger characteristics:<br>Amplitude: 1.5 to 5.0 V<br>Pulse width: 0.5 to 3.0 $\mu$ s |

Table 3-13. Complete Alinement and Adjustment Procedures Using AN/APM-305A—continued

| STEP                                  | PROCEDURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | REMARKS |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
|                                       | PUT of AN/USM-281A, and connect probe to A INPUT.                                                                                                                                                                                                                                                                                                                                                                                                                                          |         |
|                                       | g. Connect AN/USM-281A probe to A3TP6, and set MAIN TIME/DIV to 10 USEC. Set AN/APM-305A SCOPE TRIG/FREQ MEAS DELAY (USEC) MULT to 1.8, and observe pulse on A INPUT of AN/USM-281A. Adjust A3R215 for a pulse width of 92 $\mu$ s. Disconnect probe from A3TP6.                                                                                                                                                                                                                           |         |
|                                       | h. Connect probe to A3TP7 and observe negative-going decode trigger on A INPUT of AN/USM-281A. Set MAIN TIME/DIV to 50 $\mu$ SEC, and use HORIZONTAL POSITION to aline decode trigger with left-most vertical graticule (timing reference). Disconnect probe from A3TP7, and connect it to A3TP8. Observe positive pulse on A INPUT, and adjust A3R224 for a pulse delay of 300 $\mu$ s (six graticules) from the decode trigger at A3TP7 (timing reference). Disconnect probe from A3TP8. |         |
| 14. Mode 4 reply limiter adjustments. | a. Set AN/APM-305A MEASUREMENT PRF RANGE to X1K, PRF SELECT X1/2/X1 to X1/2, PRF SELECT RANGE TO X1K, in that order.                                                                                                                                                                                                                                                                                                                                                                       |         |
|                                       | b. Adjust A3R29 until AN/APM-305A MEASUREMENT meter indicates an average count of 2000 Hz.                                                                                                                                                                                                                                                                                                                                                                                                 |         |
|                                       | c. Set AN/APM-305A PRF SELECT RANGE to X100, PRF SELECT X1/2/X1 to X1, MEASUREMENT PRF RANGE to X100, in that order.                                                                                                                                                                                                                                                                                                                                                                       |         |
| 15. Mode 4 audio level adjustments.   | a. Remove probe from AN/USM-281A. Remove cable from AN/APM-239A MODE 4 ENABLE TRIG, and connect between MODE 4 AUDIO and A INPUT of AN/USM-281A with termination. Remove cable from AN/APM-305A MEASUREMENT DEMOD VID OUT, and connect to AN/APM-239A MODE 4 AUDIO COMMON.                                                                                                                                                                                                                 |         |
|                                       | b. Set AN/APM-305A MEASUREMENT FUNCTION SELECT to PRF CHAL, and set PRF SELECT MULT for a MEASUREMENT meter reading of 1000 Hz.                                                                                                                                                                                                                                                                                                                                                            |         |
|                                       | c. Set AN/USM-281A MAIN TIME/DIV to .5 MSEC, A VOLTS/DIV and B VOLTS/DIV both to .5, B polarity to -UP. Position A INPUT and B INPUT baselines on center horizontal graticule, and set DISPLAY to A+B.                                                                                                                                                                                                                                                                                     |         |
|                                       | d. Set C-6280(P)/APX AUDIO/OUT/LIGHT to AUDIO. Waveform now represents audio signal across 150 ohms (two terminations) at a vertical scale of 0.5 volt per division.                                                                                                                                                                                                                                                                                                                       |         |
|                                       | e. Adjust A3R89 for an audio signal peak-to-peak amplitude of 3 volts (6 division).                                                                                                                                                                                                                                                                                                                                                                                                        |         |
| 16. Power supply.                     | a. Set C-6280(P)/APX (AN/APM-239A) MASTER to                                                                                                                                                                                                                                                                                                                                                                                                                                               |         |

Table 3-13. Complete Alinement and Adjustment Procedures Using AN/APM-305A - continued

| STEP                                 | PROCEDURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | REMARKS          |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| voltage and overcurrent adjustments. | <p>OFF. Disconnect cable from PS1P2 and XPS1P2 in setup shown in figure 3-9.</p> <p>b. Loosen two slotted lift-out screws (1, fig. 4-18, TM 11-5895-490-35) and remove power supply (PS1). Remove 12 screws (1, 3, 6 through 11, 13, 20, 21, and 22, fig. 4-22, TM 11-5895-490-35) and remove cover and clamp.</p> <p><b>NOTE</b></p> <p>If tester is not available, proceed to <i>m</i> below and use load bank described in section III.</p> <p>c. Connect Tester-Dummy Load TS-3243/APM to PS1P1 and PS1P2 by means of connectors P1 and P2, respectively. Connect differential voltmeter, MIL-V-9989 between TP1 and TP2 of the tester. Adjust differential voltmeter RANGE control to 500-Volt POSITION.</p> <p>d. Place the power supply in position so that R63 and R64 are available for adjustment, (fig. 4-23, TM 11-5895-490-35). Adjust resistor R64 fully counterclockwise (at least 20 turns).</p> <p><b>WARNING</b></p> <p>Lethal voltages are present when power is applied to the test setup using Tester-Dummy Load TS-3243/APM. These dangerous voltages are present on red A1 wire, on terminal E5 of the tester, and on terminal A1 in the open power supply.</p> <p>e. Place RESERVE LOAD switch S1 at OFF position.</p> <p>f. Place POWER switch S2 at ON position.</p> <p>g. Adjust resistor R63 (see fig. 4-23, TM 11-5895-490-35) for an indication of 310 + 16, -6 vdc on the differential voltmeter.</p> <p>h. Measure power supply voltages as directed in table 4-25, TM 11-5895-490-35, steps 2 through 9. If the voltages do not meet the limits specified in table 4-25, TM 11-5895-490-35 and <i>g</i> above, adjust R63 until all voltages are within limits specified, including differential voltmeter reading.</p> <p>i. Place RESERVE LOAD switch S1 to ON.</p> <p>j. Set differential voltmeter at VTVM position. Adjust resistor R64 clockwise until the output voltage reading on the differential voltmeter drops to 0 indicating that the overcurrent circuit is just beginning to operate. Proper operation of the overcurrent circuit is indicated by periodic attempts to rise shown by any of the output voltages. This should occur at a 1- to 5-second interval.</p> <p>k. Adjust resistor R64 counterclockwise until the</p> | 310 + 16, -6 vdc |

Table 3-13. Complete Alignment and Adjustment Procedures Using AN/APM-305A - continued

| STEP | PROCEDURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | REMARKS                                                            |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|
|      | <p>overcurrent circuit just drops out of operation as indicated by a reading of <math>310 \pm 16, -6</math> vdc on the differential voltmeter. Set R64 approximately one turn further counterclockwise from this point.</p> <p>l. Verify that resistor R64 is adjusted properly by switching the RESERVE LOAD switch S1 from ON to OFF several times while observing that reading on differential voltmeter remains steady, then leave the switch in the OFF position. Proceed to w below.</p> <p>m. Connect load bank (fig. 3-1, TM 11-5895-490-35) to PS1P2 using cable disconnected in a above. Connect load bank ground to PS1TP1 ground. Connect cable assembly, power supply test (part number 4023656-0501, fig. 4-4, TM 11-5895-490-35) between PS1P1 and XPS1P1. Connect differential voltmeter, MIL-V-9989 between TP1 and TP2 of load bank (fig. 3-1, TM 11-5895-490-35). Adjust RANGE control to 500-volt position.</p> <p>n. Place PS1 in position so that R63 and R64 are available for adjustment. Adjust resistor R64 (fig. 4-23, TM 11-5895-490-35) fully counterclockwise (at least 20 turns).</p> <p style="text-align: center;"><b>WARNING</b></p> <p>Lethal voltages are present when power is applied to test setup load bank. These dangerous voltages are present on A1 wire as shown in figure 3-1, TM 11-5895-480-35, on related resistors, terminals and wiring in load bank, and on A1 terminal in open power supply.</p> <p>o. Set C-6280(P)/APX (AN/APM-239A) MASTER to STBY for 1 minute, then to NORM.</p> <p>p. Adjust resistor R63 (fig. 4-23, TM 11-5895-490-35) for an indication of <math>310 \pm 16, -6</math> vdc on the differential voltmeter.</p> <p>q. Ensure that input power is less than the following limits:</p> <ol style="list-style-type: none"> <li>(1) 100 VA (115 vac at 0.869 Amp) ac voltage source.</li> <li>(2) 70 Watts (27.5 vdc at 2.54 Amp) dc voltage source.</li> </ol> <p>r. Measure power supply voltages as directed in table 4-25, TM 11-5895-490-35, steps 2 through 9. If voltages do not meet the limits specified in table 4-25, TM 11-5895-490-35, and p above, adjust R63 until all voltages are within limits specified, including differential voltmeter reading.</p> <p>s. Place switch S1 on load bank to ON.</p> <p>t. Adjust resistor R64 clockwise until the output</p> | <p style="text-align: center;"><math>310 \pm 16, -6</math> vdc</p> |



Table 3-13. Complete Alinement and Adjustment Procedures Using AN/APM-305A—continued

| STEP | PROCEDURE                                                                                                                                                                                                                                                                                                 | REMARKS                |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
|      | voltage reading on the differential voltmeter drops to 0 indicating that the overcurrent circuit is just beginning to operate. Proper operation of the overcurrent circuit is indicated by periodic attempts to rise shown by any of the output voltages. This should occur at a 1- to 5-second interval. |                        |
| u.   | Adjust resistor R64 counterclockwise until the output voltage reading on the differential voltmeter is approximately $310 + 16, -6$ vdc indicating that the overcurrent circuit is no longer operating. Set R64 approximately one turn further counterclockwise from this point.                          | $310 + 16$<br>$-6$ vdc |
| v.   | Verify that resistor R64 is adjusted properly by switching S1 on load bank from ON to OFF several times while observing that reading on differential voltmeter remains steady. Then leave S1 in OFF position.                                                                                             |                        |
| w.   | To reassemble and replace the power supply, use procedure in paragraph 4-33z, TM 11-5895-490-35, steps 44 and 45 and paragraph 4-33aa, TM 11-5895-490-35.                                                                                                                                                 |                        |

### 3-18. Performance Tests and Measurements Using Transponder Test Set AN/APM-305A

The following tests and measurements are applicable when using the AN/APM-305A test set and associated test equipment.

#### WARNING

Ensure that the MASTER switch, on the C-6280(P)/APX on the AN/APM-239A, is in OFF or STBY before disconnecting cable between ANT. J5 on the receiver-transmitter and MAIN RF IN/OUT on the AN/APM-305A. This prevents damage to the receiver-transmitter.

a. *Preliminary Procedures.* Assemble and connect the receiver-transmitter and test equipment as shown in figure 3-1, and described below. All test equipment should be allowed to warm up for a minimum of 10 minutes before starting test procedures.

(1) *Test Set, Transponder, AN/APM-239A with C-6280(P)/APX inserted.*

(a) Connect PWR INPUT to the 115 vac, 400 Hz voltage source.

(b) Connect TRANSPONDER power and control jack to POWER, CONTROL and VIDEO jack (J1) on the receiver-transmitter.

(c) Connect SUPPRESSION to SUPPR OUT on AN/APM-305A.

(d) Set all controls and switches as directed in table 3-3.

(2) *Test Set, Transponder AN/APM-305A.*

(a) Connect POWER connector to 115 vac 60 or 400 Hz.

(b) Connect DEMOD VID OUT to B INPUT on AN/USM-281A.

(c) Connect MKRS OUT to 75 ohm termination of A INPUT on AN/USM-281A.

(d) Connect SCOPE TRIG OUT to MAIN EXT INPUT on AN/USM-281A.

(e) Connect SUPPR OUT to SUPPRESSION IN on AN/APM-239A.

(f) Connect MODE 4 to MODE 4 COMPUTER on AN/APM-239A.

(g) Connect MAIN RF IN/OUT to ANT. J5 on RT-859/APX-72.

(h) Set all controls and switches as shown in table 3-2.

(3) *Oscilloscope, AN/USM-281A.*

(a) Connect power cord to the 115 vac, 60 Hz voltage source.

(b) Ensure that MAIN EXT INPUT is connected to SCOPE TRIG OUT on AN/APM-305A.

(c) Ensure A INPUT is connected to MKRS OUT



on AN/APM-305A.

(d) Ensure that B INPUT is connected to DEMOD VID OUT on AN/APM-305A.

(e) Set POWER ON.

(f) Set all controls and switches as shown in table 3-1.

(4) Receiver-Transmitter RT-859/APX-72, RT-859A/APX-72.

(a) Ensure that POWER, CONTROL and VIDEO jack J1 is connected to the TRANSPONDER power and control jack on the AN/APM-239A.

(b) Ensure that ANT. J5 is connected to MAIN RF IN/OUT on the AN/APM-305A.

(c) Set MODE 2 code switches to 7777.

b. Starting Procedures. Preset and adjust controls and switches as follows:

(1) Ensure that C-6280(P)/APX (AN/APM-239A) MASTER is set to OFF before making the preliminary AN/APM-239A POWER MODE, 6 AMP POWER, and METER SELECT settings specified in table 3-3.

(2) With one exception, C-6280(P)/APX MASTER may be set to any required position without delay. The exception is the OFF position. From the OFF position, the MASTER switch should be set to STBY for at least 1 minute to assure adequate receiver-transmitter warmup before advancing to any other position.

(3) Verify that AN/APM-239A SWITCHED AC POWER lamp lights and remains lighted until C-6280(P)/APX MASTER is returned to OFF.

(4) To determine the signal level applied to ANT. J5 of receiver-transmitter, note that AN/APM-305A MAIN ATTEN readings (ATTENUATION DB) represent signal levels in dBm at MAIN RF IN/OUT, which must be corrected by subtracting the 1030 MHz cable loss between MAIN RF IN/OUT and ANT. J5. For example, if the MAIN ATTEN reading is -77 (dBm) and the 1030-MHz cable loss to ANT. J5 is 0.8 dB, the signal level of ANT. J5 is -77.8 dBm, calculated as follows:

$$-77 \text{ dBm} - 0.8 \text{ dB} = -77.8 \text{ dBm.}$$

## CHAPTER 4

# DEPOT INSPECTION STANDARDS

---

See TM 11-5895-490-35, dated December 1977, section V, Depot Maintenance Procedures; part 1, Army Procedures: paragraph 5.5, Depot Inspection Standards.

## APPENDIX A REFERENCES

|                    |                                                                                                                                                                                                                                                                                                                                                  |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DA Pam 310-1       | Consolidated Index of Army Publications and Blank Forms.                                                                                                                                                                                                                                                                                         |
| DA 738-750         | The Army Maintenance Management System (TAMMS).                                                                                                                                                                                                                                                                                                  |
| TM 11-5895-490-20  | Organizational Maintenance Manual: Receiver-Transmitters, Radio, RT-859/APX-72 (NSN 5895-00-089-7179) and RT-859A/APX-72 (5895-00-160-2198) and Mountings, MT-3809/APX-72 (5895-00-063-9498) and MT-3948/APX-72 (5895-00-089-9202).                                                                                                              |
| TM 11-5895-490-20P | Organizational Maintenance Repair Parts and Special Tools Lists: Receiver-Transmitter, Radio RT-859/APX-72 and Mountings MT-3809/APX-72 and MT-3948/APX-72.                                                                                                                                                                                      |
| TM 11-5895-490-34P | Direct Support and General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools) for Receiver-Transmitters, Radio, RT-859/APX-72 (NSN 5895-00-089-7179), RT-859A/APX-72 (5895-00-160-2198) and Mountings MT-3809/APX-72 (5895-00-063-9498) and MT-3948/APX-72 (5895-00-089-9202). |
| TM 11-5895-490-35  | Intermediate and Direct/General Support Maintenance W/Depot Overhaul Instructions: Receiver-Transmitter, Radio, R-859/APX-72, RT-859A/APX-72 and Mountings, MT-3809/APX-72, MT-3948/APX-72.                                                                                                                                                      |
| TM 750-244-2       | Procedures for Destruction of Electronics Material to Prevent Enemy Use (Electronics Command).                                                                                                                                                                                                                                                   |

☆ U.S. GOVERNMENT PRINTING OFFICE : 1990 O - 277-372

Change 1

A-1/(A-2 blank)

# RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



THEN JOT DOWN THE  
DOPE ABOUT IT ON THIS  
FORM. CAREFULLY TEAR IT  
OUT, FOLD IT AND DROP IT  
IN THE MAIL.

## SOMETHING WRONG WITH THIS PUBLICATION?

FROM (PRINT YOUR UNIT'S COMPLETE ADDRESS)  
Commander  
Stateside Army Depot  
ATTN: AMSTA-US  
Stateside, N.J. 07703

DATE SENT 10 July 1975

PUBLICATION NUMBER  
TM 11-5840-340-12

PUBLICATION DATE  
23 Jan 74

PUBLICATION TITLE  
Radar Set AN/PRC-76

BE EXACT PIN-POINT WHERE IT IS

| PAGE NO | PARA-GRAPH | FIGURE NO | TABLE NO |
|---------|------------|-----------|----------|
| 2-25    | 2-28       |           |          |
| 3-10    | 3-3        |           | 3-1      |
| 5-6     | 5-8        |           |          |

FO3

IN THIS SPACE TELL WHAT IS WRONG  
AND WHAT SHOULD BE DONE ABOUT IT:

Recommend that the installation antenna alignment procedure be changed throughout to specify a 2° IFF antenna lag rather than 1°.

REASON: Experience has shown that with only a 1° lag, the antenna servo system is too sensitive to wind gusting in excess of 25 knots, and has a tendency to rapidly accelerate and decelerate as it hunts, causing strain to the drive train. Hunting is minimized by adjusting the lag to 2° without degradation of operation.

Item 5, Function column. Change "2 db" to "3db."

REASON: The adjustment procedure the the TRANS POWER FAULT indicator calls for a 3 db (500 watts) adjustment to light the TRANS POWER FAULT indicator.

Add new step f.1 to read, "Replace cover plate removed step e.1, above."

REASON: To replace the cover plate.

Zone C 3. On J1-2, change "+24 VDC to "+5 VDC."

REASON: This is the output line of the 5 VDC power supply. +24 VDC is the input voltage.

PRINTED NAME GRADE OR TITLE AND TELEPHONE NUMBER  
SSG I. M. DeSpirito 999-1776

SIGN HERE

*SSG I. M. DeSpirito*

DA FORM 2028-2  
1 JUL 79

PREVIOUS EDITIONS  
ARE OBSOLETE.

P.S. -IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR  
RECOMMENDATION MAKE A CARBON COPY OF THIS  
AND GIVE IT TO YOUR HEADQUARTERS



RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



THEN...JOT DOWN THE  
DOPE ABOUT IT ON THIS  
FORM. CAREFULLY TEAR  
IT OUT, FOLD IT AND  
DROP IT IN THE MAIL.

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER

TM 11-5895-490-34-1

PUBLICATION DATE

5 Jan 82

PUBLICATION TITLE Receiver-Transmitter

RT-859A/APX-72

BE EXACT PIN-POINT WHERE IT IS

PAGE  
NO.

PARA.  
GRAPH

FIGURE  
NO.

TABLE  
NO.

IN THIS SPACE TELL WHAT IS WRONG  
AND WHAT SHOULD BE DONE ABOUT IT:

PRINTED NAME GRADE OR TITLE AND TELEPHONE NUMBER

SIGN HERE

DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS  
ARE OBSOLETE

P.S.-IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR  
RECOMMENDATION MAKE A CARBON COPY OF THIS  
AND GIVE IT TO YOUR HEADQUARTERS.

TEAR ALONG PERFORATED LINE



FILL IN YOUR  
UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS

Commander  
US Army Communications-  
Electronics Command  
ATTN: DRSEL-ME-MQ  
Fort Monmouth, New Jersey 07703

TEAR ALONG PERFORATED LINE

## RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



THEN...JOT DOWN THE  
DOPE ABOUT IT ON THIS  
FORM. CAREFULLY TEAR  
IT OUT, FOLD IT AND  
DROP IT IN THE MAIL.

**SOMETHING WRONG WITH THIS PUBLICATION?**

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER  
TM 11-5895-490-34-1

PUBLICATION DATE  
5 Jan 82

PUBLICATION TITLE Receiver-Transmitter  
RT-859A/APX-72

BE EXACT PIN-POINT WHERE IT IS

IN THIS SPACE TELL WHAT IS WRONG  
AND WHAT SHOULD BE DONE ABOUT IT:

PAGE  
NO.PARA-  
GRAPH

FIGURE NO.

TABLE  
NO.

PRINTED NAME GRADE OR TITLE AND TELEPHONE NUMBER

SIGN HERE

DA FORM 2028-2  
JUL 79

PREVIOUS EDITIONS  
ARE OBSOLETE

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

FILL IN YOUR  
UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS

Commander  
US Army Communications-  
Electronics Command  
ATTN: DRSEL-ME-MQ  
Fort Monmouth, New Jersey 07703

TEAR ALONG PERFORATED LINE

# RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



THEN...JOT DOWN THE  
DOPE ABOUT IT ON THIS  
FORM. CAREFULLY TEAR  
IT OUT, FOLD IT AND  
DROP IT IN THE MAIL.

## SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER

TM 11-5895-490-34-1

PUBLICATION DATE

5 Jan 82

PUBLICATION TITLE Receiver-Transmitter

RT-859A/APX-72

BE EXACT PIN-POINT WHERE IT IS

PAGE  
NO

PARA  
GRAPH

FIGURE  
NO

TABLE  
NO

IN THIS SPACE TELL WHAT IS WRONG  
AND WHAT SHOULD BE DONE ABOUT IT:

PRINTED NAME GRADE OR TITLE AND TELEPHONE NUMBER

SIGN HERE

DA FORM 2028-2  
1 JUL 79

PREVIOUS EDITIONS  
ARE OBSOLETE

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR  
RECOMMENDATION MAKE A CARBON COPY OF THIS  
AND GIVE IT TO YOUR HEADQUARTERS.

TEAR ALONG PERFORATED LINE

FILL IN YOUR  
UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS

Commander  
US Army Communications-  
Electronics Command  
ATTN: DRSEL-ME-MQ  
Fort Monmouth, New Jersey 07703

TEAR ALONG PERFORATED LINE

Chart Transposed to  
End of Volume.





By Order of the Secretary of the Army:

Official:

ROBERT M. JOYCE  
*Brigadier General, United States Army*  
*The Adjutant General*

E. C. MEYER  
*General, United States Army*  
*Chief of Staff*

DISTRIBUTION:

To be distributed in accordance with DA Form 12-36, Direct and General Support maintenance requirements for AN/AP X-72.



| CIRCUIT \ PIN      | 1   | 2   | 3  | 4          | 5   | 6          | 7   | 8   | 9          | 10 | 11 | 12  | 13  | 14  | 15 | 16 | 17  | 18 | 19 | 20  | 21  | 22  | 23 | 24 | 25 | 26 | 27 | 28  | 29 | 30         | 31 | 32  | 33 |    |
|--------------------|-----|-----|----|------------|-----|------------|-----|-----|------------|----|----|-----|-----|-----|----|----|-----|----|----|-----|-----|-----|----|----|----|----|----|-----|----|------------|----|-----|----|----|
|                    |     |     |    |            |     |            |     |     |            |    |    |     |     |     |    |    |     |    |    |     |     |     |    |    |    |    |    |     |    |            |    |     |    |    |
| A1 PROCESSOR       | NC  | *   | NC | NC         | NM  | +25V<br>DC | NC  | NC  | GND        | NC | NM | GND | KEY | GND | NC | NC | NC  | NC | *  | NC  | NC  | NM  | -- | -- | -- | -- | -- | --  | -- | --         | -- | --  | -- |    |
| A2 DECODER         | NM  | NM  | NM | NM         | NC  | NC         | NC  | NC  | NC         | NC | NC | NC  | KEY | NC  | NM | NM | GND | NC | NC | NM  | NM  | NC  | NC | NM | NC | NC | NC | GND | NC | NM         | NC | NC  |    |    |
| A3 MODE 4          | NM  | GND | NM | +12V<br>DC | NC  | *          | NC  | NC  | +12V<br>DC | NC | NC | NM  | NC  | GND | NC | NC | NC  | NM | NC | NM  | KEY | GND | -- | -- | -- | -- | -- | --  | -- | --         | -- | --  | -- |    |
| A4 ENCODER CLOCK   | NM  | NM  | NM | NM         | KEY | NM         | NM  | GND | NM         | NM | NM | NM  | NM  | NM  | NM | NC | NM  | NM | NC | -3V | NC  | GND | -- | -- | -- | -- | -- | --  | -- | --         | -- | --  |    |    |
| A5 ENCODER CONTROL | GND | NM  | NM | NM         | NM  | NM         | NM  | NM  | NM         | NM | NM | NM  | NM  | NM  | NM | NM | NM  | NM | NM | NM  | NM  | NM  | NM | NM | NM | NM | NM | NM  | NM | +12V<br>DC | NM | KEY | NC | NM |
| A6 ENCODER GATING  | GND | NC  | NC | NC         | NC  | NM         | KEY | NC  | NM         | NM | NM | GND | NM  | NM  | NM | NM | NM  | NC | NM | NM  | NM  | GND | -- | -- | -- | -- | -- | --  | -- | --         | -- | --  | -- |    |

| CIRCUIT \ PIN      | 34         | 35 | 36         | 37 | 38  | 39        | 40         | 41        | 42 | 43        | 44         | 45  | 46  | 47         | 48 | 49 | 50 | 51        | 52 | 53        | 54 | 55        | 56 | 57 | 58         | 59 | 60 | 61 | 62 | 63        | 64 | 65  | 66 |    |
|--------------------|------------|----|------------|----|-----|-----------|------------|-----------|----|-----------|------------|-----|-----|------------|----|----|----|-----------|----|-----------|----|-----------|----|----|------------|----|----|----|----|-----------|----|-----|----|----|
|                    | A          | B  | C          | D  | E   | F         | H          | J         | K  | L         | M          | N   | P   | R          | S  | T  | U  | V         | W  | X         | Y  | Z         |    |    |            |    |    |    |    |           |    |     |    |    |
| A1 PROCESSOR       | NC         | NM | -6V<br>DC  | NM | NM  | NM        | +12V<br>DC | +6V<br>DC | NM | NC        | NC         | NC  | KEY | NC         | NC | NC | NC | NC        | NC | NC        | NM | NM        |    |    |            |    |    |    |    |           |    |     |    |    |
| A2 DECODER         | GND        | NM | NM         | NM | GND | NM        | NC         | NM        | NC | NM        | +25V<br>DC | NC  | KEY | NM         | NC | NC | NM | -6V<br>DC | NC | NC        | NM | NC        | -- | -- | --         | -- | -- | -- | -- | --        | -- | --  | -- |    |
| A3 MODE 4          | +12V<br>DC | NM | -6V<br>DC  | NM | NC  | +6V<br>DC | +28V<br>DC | NM        | NM | NM        | NM         | NM  | NM  | NM         | NM | NM | NM | *         | NM | KEY       | NM | +6V<br>DC | NM | NM | +12V<br>DC | NM | NM | NM | NM | NC        | NC | NC  |    |    |
| A4 ENCODER CLOCK   | NM         | NM | NM         | NM | KEY | NM        | -6V<br>DC  | -3V<br>DC | NM | NM        | NM         | NM  | NM  | NM         | NM | NM | NM | NC        | NM | NC        | NM | --        | -- | -- | --         | -- | -- | -- | -- | --        | -- | --  | -- |    |
| A5 ENCODER CONTROL | NM         | NM | NM         | NM | NM  | NM        | NM         | NM        | NM | NM        | NC         | NM  | NM  | NM         | NM | NM | NM | NM        | NM | NM        | NM | NM        | -- | -- | --         | -- | -- | -- | -- | --        | -- | --  | -- |    |
| A6 ENCODER GATING  | GND        | NC | +25V<br>DC | NC | NC  | NM        | KEY        | NM        | NM | -6V<br>DC | NM         | GND | NM  | +12V<br>DC | NM | NM | NM | NC        | NC | -3V<br>DC | NM | GND       | NC | NM | NM         | NM | NM | NM | NM | -6V<br>DC | NM | KEY | NM | NM |

NM - not measured      \*NC RT-859/APX-72  
NC - no connection    \*NM RT-859A/APX-72

EL7BI013

Figure FO-1. Circuitboard Subassemblies Voltage Measurements.

best copy available